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Editorial Notes

Calorific Value and Benzole Recovery

RECENTLY we have put forward a few suggestions regarding declared calorific value, throughput, steaming, and the coke market; we have coupled all these considerations with the question of benzole recovery. We have made these suggestions only after a good deal of thought and with a view not at all of teaching the gas engineer his job—that is so obviously not within the province of the "JOURNAL"—but of stimulating thought. We may be forgiven if we hold the opinion, as we do, that ideas on the carbonizing process as carried out by the Gas Industry can quite easily become "set," and that there is inevitably a tendency to cling to the *status quo*.

We have expressed our bewilderment at the extraordinary variations in calorific value throughout the country, and the view that the many divergencies within a comparatively narrow range are quite unjustifiable. A week or two ago we analyzed a dozen recent declarations in calorific value and pointed to the fact that out of these changes there were no fewer than seven different values, some of them differing by as little as 5 B.Th.U. We put forward the view that three, or four, at the most, values would well suffice. The three we should favour would be 500, 475, and 450 B.Th.U. If a fourth, then 425 B.Th.U. On practical as well as on theoretical grounds we quite fail to see why there should be such variation in declared calorific values among undertakings carbonizing the same or similar types of coal in the same or similar systems of carbonizing plant. It will be understood, of course, that we are considering gasmaking as generally practised, and not the merit or otherwise of deliberately making gas of a very low calorific value, such as is advocated in some quarters.

Another suggestion we made was that the development of the coke market has suffered from the maximum make of gaseous therms per ton idea. We said: "The Gas Industry, instead of going all out to market a good smokeless fuel in an almost limitless field, adopted a weak attitude. Instead of dictating the market, by which we mean putting forward every effort possible in the sale of coke, it allowed market conditions to dictate gas making policy." We suggested that this attitude may have had an unfortunate effect on the production of the cheapest therm. We asked the Gas Industry not to be lukewarm about the coke market, but to organize more to extend coke sales.

Then we turned to the question of benzole recovery from the gas made in continuous vertical retorts. Steaming of the charge is practised to bring the calorific value of the gas down to the declared calorific value. Would it not pay better, we queried, to make a "fatter" therm with less steaming and reduce the calorific value by extracting benzole? The value of benzole recovery as a revenue producer to the gas undertaking depends on the price ratio between coal and coke, but we think that the influence benzole recovery has on the price at which the gaseous therm can be made is insufficiently appreciated—and we have in mind, too, that profitable benzole recovery is not confined to the large or even the medium-sized works. Plant low in capital cost and requiring a minimum of labour and attention is available for the small works.

A contributor to the discussion on one of the Papers presented at the Research Meeting of The Institution of Gas Engineers last month stated: "We have, from time to time, considered the introduction of benzole recovery plant, but apart from constructional complications on the works we have always found that the water gas therm we obtain from the heavy steaming in vertical retorts is a cheaper way of diluting the high calorific value of gas to the declared value of 450 B.Th.U. than is the benzole recovery method." We would like to examine this statement rather closely.

Of late we have heard of difficulty in disposing of coke. Benzole recovery necessarily implies the placing of more coke on the market. Fears lest such a policy should be adopted have been expressed. As we have said, we do not attempt to dictate policy, but we do want to stimulate thought; and in our issue to-day we attempt to show what the Gas Industry is missing if it cannot dispose of the extra coke consequent on benzole recovery. It is, in our opinion, losing heavily. And it is for this reason that we urge development of the coke market in what we have spoken of as a limitless field.

We know how difficult it is to generalize on this subject

of benzole recovery—a subject at the same time fascinating and complex. We think, however, that much confusion is apt to arise as the result of the method commonly adopted in considering its economic possibilities. To our mind, the best way of viewing the problem is to regard the benzole recovery plant *per se*—to arrive at a simple balance-sheet giving the net revenue actually gained by having the plant in operation. In other words, the revenue per gallon of benzole after allowing for all operating and capital charges on the benzole recovery plant. That revenue is definitely available. This is not a new idea by any means. In the "JOURNAL" for Nov. 27, 1929, we published the Presidential Address of Mr. F. Firth, of the Leeds Gas Department, to the Yorkshire Junior Gas Association, in which, in a most lucid argument, he advocated the determination of that figure as a first step in studying the economics of benzole recovery.

We have carried out a series of calculations which we think will be of interest; and our results are published in to-day's "JOURNAL." We think they merit study. We have considered the case of a works having continuous vertical retorts only and distributing gas having a gross calorific value of 475 B.Th.U. We have taken the two cases of this hypothetical works first without benzole recovery and secondly with benzole recovery. The gasmaking data are those given by Mr. F. B. Richards in his Paper, "Perspective in Carbonizing Costs," to the Eastern Counties Gas Managers' Association in 1934. It was published in the "JOURNAL" for Oct. 31, 1934. We think no one will quarrel with those data. We know they are borne out in practice. The data refer to a works distributing 15,000 therms, or 3·16 million cu.ft., of 475 B.Th.U. gas per day. We assume that no change is made in the declared calorific value when extracting 3 gallons of crude benzole per ton of coal carbonized. This means a reduction in steaming on the retorts to make gas of 500 B.Th.U. per cu.ft. As steaming is reduced the throughput of coal per retort per day can be increased to such an extent that the thermal yield per retort per day remains the same as when steaming down to 475 B.Th.U.

We have taken a fixed price for coal at 22s. a ton and have worked out the incidence of benzole recovery on the cost of gasmaking over a wide range of prices at which the coke can be sold. In other words, the coal-coke price ratio is taken fully into account. As a net revenue for benzole we have taken 8d. per gallon as a reasonable figure. We certainly know that this is being obtained. As the price of coke for sale falls, the financial advantages of benzole recovery naturally diminish; and on our figures we calculate that only when the extra coke made due to benzole recovery falls to a selling price below 5s. 4d. per ton does benzole recovery become unprofitable. If the extra coke for sale fetches a price in excess of 5s. 4d. a ton, then benzole recovery shows a profit which can be credited to the cost of gas manufacture. We set out in a table what this profit means over a range of coke selling prices from 5s. 4d. to 26s. 4d. per ton. We calculate that with a selling price of coke of 26s. 4d., the reduction in costs of gas manufacture amounts to a matter of 0·3d. per therm. Gas engineers will realize what this means in terms of annual saving in £ s. d.

Of course, if gas engineers cannot sell the extra coke due to benzole recovery at a figure greater than 5s. 4d. per ton, we have nothing more to say.

The installation of a benzole plant on the gas-works automatically creates a new and very large consumer for gas. This consumer is very adaptable and does not demand a regular supply as does the ordinary consumer. In case of an emergency demand the benzole plant can temporarily be taken out of operation. Finally, there is another aspect. We mention it last not because it is of least importance—and that is benzole recovery from the point of view of national welfare.

The Stretford Coal Price Appeal

THE Committee of Investigation of the Midland Coal District have now given their decision in the appeal of the Stretford and District Gas Board with regard to the price of coal fixed by the Midland Coal Selling organization. That decision upheld the prices fixed by the Coal Selling organization and was therefore against the Stretford and District Gas Board.

We do not pretend to have studied in detail the evidence placed before the Committee, but such information as has been placed before us serves only to confirm the doubts which we have so frequently expressed in the "JOURNAL" as to the merits of the Committees as at present constituted. As our readers are aware, the District Committees of Investigation consist of five members—two representatives of coal, two of the consumers, and a legal chairman. The coal representatives cannot pretend that they are impartial; one represents the owners and another the workers. However greatly these gentlemen may differ in political matters, they are at one in presenting a united front to the consumer. The coal owners' representative plunges fervently into the accounts of the gas undertaking, while the workers' representative seeks to extract from witnesses expressions of sympathy for the miners. To these gentlemen any sign of dissatisfaction with the price at which the Coal Selling organization so kindly permits coal to be delivered to gas undertakings is a sin verging upon mortal. It is further to be remarked that both these gentlemen are, unlike the other members of the tribunal, experts dealing with their own subject. What is the opinion of the consumers' representative, who may be a small householder, when opposed to the coal representative "who knows the pit well because he worked there as a boy?"

The consumers' representatives are public-spirited men who gratuitously render a service to the public; but even they are nominated by sectional interests. While it can be taken for granted that the coal representatives will form a common front, no such assumption can be made with regard to the consumers' representatives. The hypothetical householder may think—and presumably he is entitled to think—that a high price of coal to gas undertakings is a phenomenon which has much to commend it.

The chairman is a lawyer and as such must necessarily consider the law. We freely admit that the substitution of the original chairmen by impartial lawyers does represent an improvement in the constitution of the Committee.

It must be remembered, however, that the chairman has to work an Act of Parliament which admittedly permits a monopoly, and under which schemes are made for the express purpose of enabling the highest price possible to be obtained. Moreover, he finds that discrimination as between one class of consumer and another is definitely permitted by the Act.

Turning to the Stretford case, we find both the coal representatives in constant and vociferous attendance, while of the

consumers' representatives one attends half-time and the other, through no fault of his own, fails to put in an appearance. Such is the Court which the wisdom of Parliament has devised, and to which it is the astonishment of the Mines Department that public utilities do not more frequently refer.

What happens now? The Gas Board have the right to appeal to the new Appeal Tribunal to be set up under the new Coal Act. Nobody knows what the constitution of this Court will be, and nobody can say whether an application to it will be in the form of an appeal or a re-hearing. No one can tell whether new evidence may be offered, or whether the new Court will review from the transcript the evidence previously offered, without hearing the actual witnesses. Nobody knows why public utilities, while their own charges are controlled by law, are expected cheerfully to carry the ever-increasing burden of coal costs.

A Judgment by Agreement

On Wednesday of last week the hearing was commenced of an action by Mrs. M. A. Gann, of the City Temperance Hotel, Peterborough, and of actions by two Leicester commercial travellers against the Peterborough Corporation, the Peterborough Gas Company, and a public works contractor, Mr. G. H. Greasley, of Leicester. The hearing was in the King's Bench Division of the High Court before Mr. Justice Stable. It had been anticipated that the hearing would extend over ten or eleven days. Following a consultation between counsel, however, a settlement was arrived at and judgment was entered for the plaintiffs. The actions were a sequel to an explosion at the hotel in November, 1936, when considerable damage was done to the premises and several people were injured. The actions were in the nature of test actions, and dependant upon them were the claims of four other persons who were injured. It was alleged that the accident was due to the negligence of the Corporation, or of the Gas Company, or of Mr. Greasley, or of all of them. The case against the Corporation was that their work of excavating and relaying the highway was improperly carried out, against the Gas Company that they failed to take reasonable steps to prevent the escape of gas from a main.

The Corporation denied negligence. If, they argued, the explosion was due to an escape of gas, then the Gas Company were solely responsible. Both the Gas Company and Mr. Greasley denied negligence.

Counsel for Mrs. Gann explained that it was arranged that the case should be a test case. All the defendants had agreed to be bound by the decision. Counsel for the Corporation stated that, in consultation with counsel for the Company, an agreement had been reached whereby each would bear 50% of the responsibility for damage to the hotel caused by the explosion. Mr. Greasley was working for the Corporation, and there was a contract which provided for a complete indemnity for the Corporation. All the parties were agreed as to recovery. After consultation among counsel judgment was entered for Mrs. Gann against all the defendants for £700 with costs. It was further directed by the Judge that the cases of the two Leicester commercial travellers and the other four cases should stand over, and that an application should be made in relation to all of them, to be put on the lists for some day convenient to all parties.

Industrial Gas Development.

In October last we published a Paper given by Mr. H. P. Lupton, of the Liverpool Gas Company, to the Manchester District Association of Gas Engineers. It was concerned with the experiences of a Gas Development Centre—that at Liverpool—and it held a lesson which we said at the time should be taken to heart. That lesson is that no gas undertaking can afford to stand outside the Industrial Centres Scheme. Each undertaking should link up with and support the particular Centre covering its area of supply, for every undertaking has some potential industrial or commercial business. The Development Scheme was well planned and is well organized; it has added alike to the Industry's business and prestige. In a Paper to the Wales and Monmouthshire Junior Gas Association last month Mr. N. H. Greenway, of Cardiff, gave examples of how the Cardiff Centre has been able successfully to tackle industrial enquiries and to retain and extend business. One of the examples was the application of gas to the manufacture of furniture and boot polishes. Work of the Centre resulted in great improvements on existing gas equipment. The original gas equipment used for melting waxes and other compounds had a gas consumption of 125 cu.ft. per batch per day, and the time taken for the first melt was 3½ hours. With the new equipment the average gas consumption per batch per day is 27 cu.ft., and the time taken for the first melt is 35 minutes. It is not surprising that the firm in question purchased more gas appliances for space heating and other purposes. This is only one instance of many we could quote which adds point to our contention that the Industrial Centres should have 100% support.

Personal

Mr. A. W. SAULTER has been appointed to the Board of Directors of Messrs. Clough (Croydon), Ltd., Croydon, but retains his position of General Manager.

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Major GEOFFREY KITSON has retired from the Chairmanship of the Leeds Corporation Gas Committee and has been succeeded by Alderman A. R. BRETHERICK.

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Mr. R. J. MILBOURNE, Assoc.M.Inst.C.E., F.C.S., has been elected a member of the Executive Committee and Council of the Bribery and Secret Commissions Prevention League, Incorporated.

Forthcoming Engagements

December

15.—I.G.E.—Refractory Materials Joint Committee, 2.30 p.m.
15.—S.B.G.I.—Council Meeting, 2.30 p.m.
16.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.
16.—Southern Association (Western District).—Commercial Meeting, Rougemont Hotel, Exeter, 2.30 p.m.
21.—B.G.F.—Council, Gas Industry House, 12 noon.
21.—I.G.E. and S.B.G.I.—Ad Hoc Joint Committee at Gas Industry House, 2.30 p.m.

1939.

January

7.—London and Southern Juniors.—Visit to Wandsworth Gas-Works.
7.—Scottish Eastern Juniors.—Short Paper Meeting at Dunfermline.
12.—Midland Juniors.—Lecture by A. T. Green, F.I.C., of the British Refractory Research Association.
14.—Scottish Western Juniors.—Visit to Maxol Heaters, Ltd., Manchester.
14.—Southern Association (Eastern District).—At Gas Industry House, 2.30 p.m. Discussion on "Hire-Purchase with Special Reference to Hire-Purchase Act, 1938, and Commission to Employees."
14.—Yorkshire Juniors.—Paper by H. A. Fells, of Sheffield.
17.—London and Southern Juniors.—Meeting at Kennington. Paper by G. S. J. Knott on "Meters and Standards."
19.—L.C.C.A.—At Gas Industry House. Finance Committee, 10.45 a.m.; Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m.
21.—Wales and Monmouthshire Juniors.—Meeting at Newport.
21.—Western Juniors.—Visit to Cheltenham. Paper by Leopold Friedman, of Ascot Gas Water Heaters, Ltd.
28.—Scottish Western Juniors.—Visit to Parkinson & Cowan, Ltd., Glasgow.

February.

1.—London and Southern Juniors.—Visit to Cricklewood Works of British Oxygen Company.
1.—Manchester and District Juniors.—Visit to Staveley Coal and Iron Company, Ltd., Chesterfield.

Retirement of Professor Cobb

A presentation ceremony in connexion with the retirement of Professor J. W. Cobb was held on Friday, Dec. 9, in the University of Leeds. Major G. H. Kitson, Chairman of the Livesey Advisory Committee, presided over a large gathering of members of the University and other friends. The Gas Industry was represented by the President of The Institution of Gas Engineers, Mr. Robert Robertson; Mr. H. C. Smith, Tottenham; Mr. John Terrace, London; Mr. C. S. Shapley, Leeds; Mr. H. E. Bloor, York; Mr. F. B. Richards, London; Mr. Charles Wood and Mr. E. J. Sutcliffe, Bradford; Dr. H. G. Colman, London; and Mr. D. M. Henshaw and Mr. F. B. Holmes, Huddersfield.

Apologies regretting absence were received from Dr. H. Hollings, Dr. A. C. Monkhouse, and Dr. H. S. Houldsworth. Mr. J. H. Brearley wrote adding that "the gathering concerns one who has rendered long and faithful service both to the University and to the Gas Industry, the value of which cannot be put in terms of sterling. It is characteristic of Professor Cobb that he should allocate the fund (after a 'token' presentation) to the purposes named, a gesture by which he will be gratefully remembered by both the Gas Industry and the students who will benefit by it."

Major Kitson, after some appreciative remarks, presented to Professor Cobb a radiogram and a bound volume containing the names of contributors. He then presented to the University a portrait of Professor Cobb—a copy of which will be presented to The Institution of Gas Engineers—and a cheque to inaugurate the Cobb Fund.

This Fund has now reached £850, of which £583 16s. 6d. was contributed through The Institution of Gas Engineers by its own members and by members of the National Gas Council and of the Society of British Gas Industries. After defraying the expenses of presentations, &c., there will remain a balance of some £750. In accordance with the wishes of Professor Cobb it is proposed to present this to the University of Leeds in order that the income from it may be used to assist students of the Department of Coal, Gas, and Fuel Industries with Metallurgy to meet the cost of maintenance while at the University or to cover other expenditure necessary for their studies or researches. It is suggested that grants from this fund be made by the University on the recommendation of the Head of the Department.

After the Vice-Chancellor (Mr. B. Mouat Jones) had received the cheque, Mr. Robert Robertson spoke in support. He said that Professor Cobb was held in the highest esteem by everyone in the Gas Industry. He was already an Honorary Member of the Institution, but from now on he could regard himself as an Honorary Member of the Gas Industry at large.

Professor Priestley referred to the esteem in which Professor Cobb was held in the University and the great store placed upon his judgment in the important matters which came before the higher administrative bodies of the University. For four years Professor Cobb had held the important office of pro-Vice-Chancellor.

Mr. H. J. Hodsman, speaking on behalf of the present and past members of the Department, drew a contrast between to-day when the study and research in fuel problem had become almost a fashion and the conditions existing in 1912 when Professor Cobb took office. The University of Leeds had embarked on this pioneering effort—the first of its kind in this country. The Department was in 1912 still in its infancy—a fretful and ailing infant at that. There was no recognized curriculum and no standard of comparison to judge a degree in gas engineering. Then came the four years' interruption of the War. Now there are scores of graduates—distributed all over the world. Important investigations had been associated with Professor Cobb and the Department. Whereas it originally occupied only a part of the present building, this was now crowded with very varied pieces of work. It is only by this retrospect that full justice could be done to the measure of Professor Cobb's achievement.

Professor Cobb, in replying, said that the University prized its association with the Gas Industry, and that association had now reached an extremely interesting stage. He hoped it would continue under the leadership of Professor Townend and develop the opportunities which appeared now to be presenting themselves. Professor Cobb reviewed the changes which had taken place in the University in his time. He had noted its growing consciousness of being a University and assurance of its important position. Respect for tradition had been combined with the pioneering spirit essential if a modern University was to develop on proper lines. This he ascribed in a large measure to the influence of Professor Smithells and Sir Michael Sadler.

Referring to the Fund, he said that some students had a rather cramped time. Committees existed to alleviate their lot and did so, but things which escaped the jurisdiction of a Committee might be known to the Head of a Department. This was the reason for suggesting that grants from his Fund should be made on the recommendation of the Head of the Department.

Obituary

Octavius Thomas.

His many friends in the Industry, and especially in South Wales, will learn with the deepest regret of the death on Sunday of Mr. Octavius Thomas.

In paying tribute to one who has put in a lifetime of useful work for the Industry whose interests he had so closely at heart, we cannot do better than quote from the "JOURNAL" of Oct. 30, 1935, when we congratulated Mr. Thomas on the completion of sixty years' service in the gas and water industries.

The life-work of Octavius Thomas began on Nov. 1, 1875. Alderman Henry Bowen, J.P., was at that date Engineer and Manager at Cardiff (of which city he was at one period Mayor) and with him Octavius Thomas served his articles. He remained at Cardiff to become Assistant Engineer under Mr. Henry Morley, but left in July, 1893, to act as Manager and Secretary of the Western Valleys Water and Gas Company at Risca, Mon. In March, 1898, he left Risca to take up the position of Engineer and Manager of the Rhondda Urban District Council's Gas and Water Works, at Pentre, which he held until his retirement in April, 1934.

The Wales and Monmouthshire Association (as it now is) of Gas Engineers and Managers—which, fortunately for them, brought him into close personal contact with so many of his colleagues—was formed in March, 1905, and ever since then our friend has been Hon. Secretary of the Association, even while acting as President. Indeed, he assisted the late Alderman Thomas Canning (the first President) to bring the Association into being. It began with about forty members, only seven of whom are now left. At the present time there are 140 odd members and associates. The Institution of Gas Engineers met at Cardiff in 1928, during the Presidency of Mr. H. D. Madden, and readers do not need to be reminded of the large share taken by Octavius Thomas in the arrangements connected with a conspicuously successful meeting.

During the 36 years which he spent at Rhondda, he saw the population double and he increased the capacity of the Gas-Works to permit of an output three times as large as was possible when he went there. At the time of his leaving, a population of some 90,000 was being supplied.

And now for just one more reflection. There are many more men in the Industry than one would ever dream of who owe a great debt of gratitude to our friend. He never obtruded himself, but if one needed advice or assistance it was to Octavius Thomas that he naturally turned with the sure knowledge that whether the advice received was palatable or otherwise it would be unfailingly correct. With a shrewd appreciation of their difficulties, he was particularly helpful to the younger men of the Industry, who will miss him in a degree only slightly less than his most intimate friends.

Octavius Thomas was happy in that he lived to see the thought, the loyalty, the affection that he unstintingly extended to others returned to him in generous measure. "Self" can never have counted less with anyone than it did with him. In these days, the word "service" is sadly over-worked, but there is no straining of it in saying that his life *was* service.

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Mr. FREDERICK WILLIAM THOMPSON, of St. Peter's Hill, Grantham, died on Dec. 7, in his eighty-ninth year. He was for many years a Director of the Grantham Gas Company.

News of the Week

Cookery Demonstrations were given by the Polmont District Gas Company, Ltd., in co-operation with the Polmont Townswomen's Guild in the Lesser Masonic Hall, Brightons, on Dec. 12, when the demonstrator was Miss Muriel Howie, of the Scottish Enamelling Company, Ltd., Larbert.

The Annual Report of the Power-Gas Corporation, Ltd., Stockton-on-Tees, shows a balance of £38,977 (against £31,356). The Directors recommend a dividend of 10% against 8%. This accounts for £30,000, and, with £7,795 going to reserve, the amount to be carried forward is £15,313 (against £14,130).

The Feu Duty on the municipal gas undertaking is to be purchased by the North Berwick Town Council. Their Works are located about a mile from the town. The feu duty amounts to over £43, and the purchase price is £995. The Council have asked the Superior of the Feu, Colonel Hamilton Grant, D.S.O., to pay his own legal expenses.

For a Waterless Gasholder the Glasgow Town Council on Dec. 8 approved a recommendation by the Gas Committee to purchase ground in Helen Street. The gasholder is estimated to cost over £100,000. Repairs to vertical retorts and ovens at Dawsholm Gas-Works were also approved, at a cost of £7,928, with reconstruction of retorts at Tradeston Gas-Works, to cost £11,792.

Good Publicity was obtained from an excellent series of cookery demonstrations recently organized by the Worcester New Gas Light Company, in conjunction with Messrs. John Wright & Co., Ltd., and Cadbury Bros. The demonstrators were Miss Hawkins, of the Radiation Research Kitchen, and Miss Stewart, of Cadbury Bros. Attendances averaged over 200 per day, and resulting sales reached a high level.

At the December Meeting of the Broadstairs and St. Peter's Urban District Council a letter was received from the Broadstairs Gas Company pointing out that the present street lighting contract expires on March 31, 1940, and stating that, if a new seven-years agreement were entered into, the Company could offer reduced charges and could, by the adoption of proposals outlined, give an increase in light output. Consideration of the letter was deferred.

The Second Lecture of the season to the outdoor staff of the Distribution Department of the Sheffield and District Gas Company took place at the chief showrooms, High Street, on Dec. 8. On this occasion the lecture was by Mr. W. J. G. Davey, B.Sc., of the Technical Staff of the Parkinson Stove Company, Ltd. It was entitled "Modern Cooker Design with Particular Reference to the 'Renown' and 'Crown' Cookers." There was a large attendance, and an interesting discussion followed.

The Christmas Holiday Spirit pervades Wright's *Christmas Gasette*, copies of which are being supplied by Messrs. John Wright & Co., Ltd. (Radiation Ltd.), to gas undertakings for distribution to their consumers. It is just the sort of thing we require in these dreary days to give us a corrective tonic of humour. There are eight pages of fun, useful hints, and sound common sense. And if you think your collar's white, wait until you see the "Sunhot" advertisement. Or, perhaps, "night starvation" is your pet foible!

To Mark the Centenary of the Ryde (Isle of Wight) Gaslight Company, the Directors presented their Secretary and Manager (Mr. F. W. Taylor) with a cheque and each of their 108 employees with a Treasury note. These presentations were made at the recent annual high tea given by the Directors to the members of the co-partnership scheme. A gathering of nearly 200 was presided over by Mr. G. E. Mears, J.P., C.A. (Chairman of the Directors), who said the amount of bonus allocated the co-partners for the past year was £836, or £10 5s. per adult member. The total they had received since the inauguration of the scheme eleven years ago amounted to £7,236. The amount of stock held by the co-partners totalled £4,550, bearing 7%. Since the scheme was in operation the co-partners had made deposits totalling £4,708 and withdrawn £4,019. Any adult member who had left his bonus and interest to accumulate would now have standing to his credit a sum of £158 10s. Alderman Mears added that in the last 20 years, on the advice of their Secretary and Manager, they had remodelled their works, which were one of the most up-to-date and efficient for their size in the south of England.

The Kitchens at the new Tunbridge Wells Assembly Hall are to be all-gas, for which Messrs. Sumerling & Co., Ltd., will supply the equipment. This is the result of a decision of the Tunbridge Wells Town Council meeting on Dec. 7.

Cooking and Washing Demonstrations were held in the Chesterfield Corporation Gas Department showrooms, Knifesmith Gate, during the week Dec. 5 to 9. The cooking and beauty demonstrations were by Miss J. E. Ford, of the Radiation Research Kitchen, assisted by Miss K. Marsh, of the Corporation Gas Department. These were opened by the Mayoress, Mrs. S. T. Rodgers, the Mayor also being present. Alderman George Clark, J.P., was in the chair. Despite the bad weather, these demonstrations were enthusiastically attended, good business resulted, and the week proved itself a great success. The washing demonstrations were by Mrs. Smith, of Messrs. Henry Slack & Sons, Ltd.

Having Owned the Gas Undertaking for over 50 years, Marple Urban District Council is giving serious consideration to the possibilities of sale to a private company. At the meeting of the Council on Dec. 5 a resolution from the General Purposes Committee was confirmed as follows: "That the Gas and Electricity Committee of the Council be and is hereby authorized to proceed with provisional negotiations with the United Kingdom Gas Company, Ltd., and if deemed necessary with other interested parties upon the question of the sale of the Council's gas undertaking; and to furnish such information relating to the undertaking as may reasonably be required by the company or other interested parties for the purpose of pursuing such negotiations."

Hall Heating, solving the problem of those wintry draughts, is being brought to the notice of the quarterly consumers of the Newcastle-upon-Tyne and Gateshead Gas Company by a photographic card, on the back of which is an appropriate message. The card shows how handsomely a modern radiant gas heater fits in with the most modern architectural conceptions. The message on the reverse side says a warm hall means a cosy house. Fitted in a convenient corner this modern gas radiant heater keeps the entrance hall, staircase, and landing delightfully warm and free from wintry draughts. A farthing per hour is all it costs for gas—and the consumer can hire one, fitted free, for 2d. a week. The card also draws attention to the fact that these heaters are ideal for the bathroom and "that small room without a fireplace."

The Price of Gas at Blackpool is to be increased. The Town Council has approved recommendations of the Gas Committee that the price should be raised from 7d. to 8d. per therm in meters up to, and including, 45 therms per quarter, and from 6½d. to 7d. per therm for meters up to 225 therms per quarter. Councillor D. J. Bailer remarked that a year ago there was an estimated profit at the beginning of the year of £12,000; the actual profit was no less than £35,000. Alderman P. Tomlinson, Chairman of the Gas Committee, said the Undertaking had a balance of £63,000 on a loan debt to pay, which had to be liquidated in the next three years. Other reasons for the increase in gas charges were the increase in the cost of coal, the fall in the price of residuals, and the increased expenditure during the construction of the new Gas-Works at Marton.

Prizes Won in a Cake-Baking Competition organized by the Newport (Mon.) Gas Company in connexion with the Newport Chamber of Trade Window Display Week were distributed by the Mayoress of Newport, Mrs. J. R. Wardell, at a recent gathering in the Company's showrooms. The competition proved a very popular feature of Display Week, and the judges had a very difficult task to select the winners from the large number of entries received. Mr. J. H. Canning, O.B.E., J.P., Engineer and Manager of the Company, presided, and offered a cordial welcome to the Mayoress. The judges were Miss E. W. Rees, of the Juvenile Instruction Centre, Miss M. E. Williams, and Miss M. Stewart, the Company's demonstrator. The Mayoress, who was presented with a bouquet by Miss Rosemary Boyd Felton, daughter of Captain C. B. Felton, expressed her pleasure at being present. Mr. J. F. Rust, Assistant Engineer and Manager, thanked the Mayoress for her gracious presence.

Middlesbrough to Manufacture Coal Gas

Coke Oven Supplies Diminished

Owing to a reduction of coke oven plant in the Borough, Messrs. Dorman Long & Co., Ltd., have had to limit their bulk supply of coke oven gas to the Middlesbrough Gas Department. It has been suggested to the Corporation that arrangements could be made for a supply of coke oven gas from the Company's Cleveland Works at Grangetown.

The Corporation Gas and Electricity Committee, however, has approved the following recommendations: "That Messrs. Dorman Long & Co., Ltd., be informed that the offer submitted by them to the Corporation's representatives at the meeting held on July 28, 1938, for the supply of gas from the Cleveland works has been very carefully considered, and that the Corporation cannot from their own point of view accept the terms contained, and are therefore reluctantly compelled to decline it. That the Corporation are prepared to continue the existing contract for the supply of gas from the Acklam works (Middlesbrough). That steps be taken immediately for the building of new carbonizing plant at the existing Gas-Works with a capacity of 4,500,000 cu.ft. a day in such a manner that the plant would be capable by extension of a capacity of 6 million cu.ft. a day and that tenders be invited forthwith."

Owing to the increased price of gas the lighting of Middlesbrough streets will cost £700 more a year than estimated.

South Yorkshire Gas Undertakings

Lecture on Street Lighting

Under the auspices of the South Yorkshire Gas Undertakings Advertising Group a lecture on street lighting was held in the Technical College, Rotherham, on Thursday evening, Dec. 8. Prior to the lecture a meal was provided at the Crown Hotel, Rotherham. Invitations had been sent by the Group Undertakings to those responsible for street lighting in the districts covered by those Undertakings, and there were over eighty acceptances comprising engineer, surveyors, and members of street lighting committees. The lecture was given by Mr. H. E. Chancellor, of Messrs. W. Parkinson & Co., who dealt chiefly with the recommendations of the Final Report of the Ministry of Transport Departmental Committee in regard to Street Lighting. The lecture was illustrated by lantern slides showing installations of gas street lighting in various parts of the country. It was evident that the lecture created great interest, as a good discussion followed the Paper, the representatives attending being anxious to obtain as much information as possible.

Women's Gas Council

Gas Cookery Demonstrators' Conference.

At the beginning of December the Women's Gas Council held a one-day Conference for Gas Cookery Demonstrators. Ninety delegates from all parts of the country came to the meeting. The Conference opened with an informal dinner on Friday, Dec. 2, at 1, Grosvenor Place, followed by a debate—"That Practical Demonstrations are more Important than Home Calls." Miss Robinson (Manchester) opened the debate, Miss Mathias (Cardiff) opposed the motion, Miss Hearn (Radiation Ltd.) seconded the opener, and Miss Goggin (Commercial Gas Company) seconded Miss Mathias. Miss E. Willans, M.B.E., was in the Chair.

The session of Saturday morning was held in the new Demonstration Hall of the Gas Light and Coke Company in Edgware Road. Mr. C. Manzini, M.C.A., gave a demonstration of pastry making.

In the afternoon Professor Drummond, D.Sc., Professor of Biochemistry at the University of London, spoke on "Dietetics in the Cookery Demonstrator's Work." Mr. R. W. Lowman (Gas Sales Manager, Gas Light and Coke Company) gave a talk on "Salesmanship in Home Service," showing how "understanding the other fellow's point of view was one of the valuable contributions of Home Service work to the growth of the Gas Industry.

After tea Miss Voysey gave a short talk on Insurance, which was greatly appreciated by her audience. The last speech of the Conference was given by Miss K. M. Halpin (Organizing Secretary of the W.G.C.), who gave a description of Home Service Work in America, and the different methods of propaganda and research used in the Gas Industry in the United States.

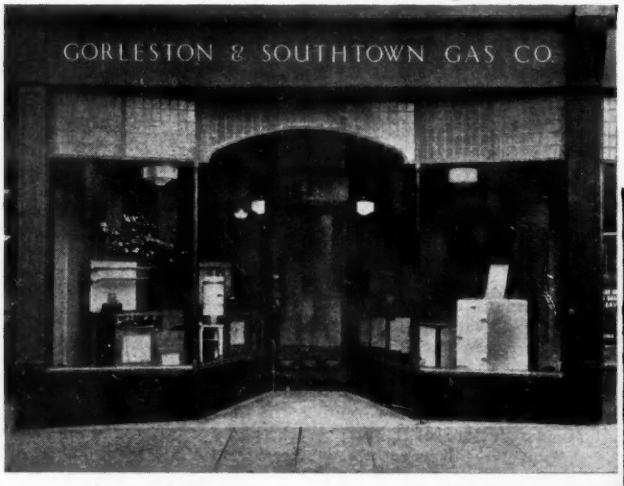
Athletic and Social

Derby Social.

The annual dance for employees of the Derby Gas Light and Coke Company was held at the Assembly Rooms, Derby, on Nov. 24. Mr. C. W. Amey, Secretary of the Company, and Mr. Hemingway Jones were M.C.'s.

Newark Sick and Dividing Club.

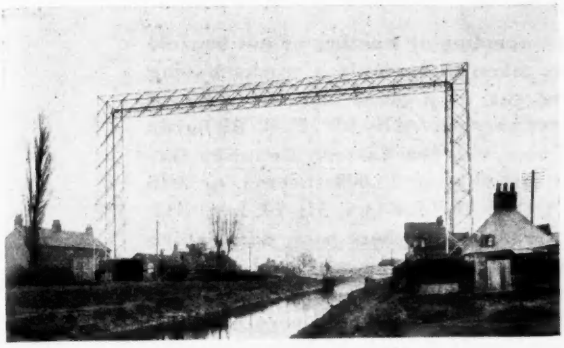
Mr. F. A. West, for a number of years Gas Engineer at Newark, Notts., paid a return visit to the town to attend the annual dinner of Newark Gas-Works Sick and Dividing Club, of which he was founder.



Here are exterior and interior views of the new Branch Showrooms and Offices opened in Baker Street, Gorleston, on Nov. 25. A comprehensive display of up-to-date gas appliances is staged within, while customers will now be able to pay accounts or transact any other business for which they previously had to visit the Company's Southtown Office.

Gorleston's New Gas Showrooms

An Interesting Method of Carrying a Gas Main Across a Tidal River



Mr. J. Demain, Engineer and Manager of the Spalding U.D.C. Gas Department, sends us the following description of an unusual method of carrying a 6-in. high-pressure gas main over a tidal waterway much used by shipping.

SOME time ago the Spalding U.D.C. Gas Department agreed with the Holbeach Gas Company to absorb their undertaking. The gas-works at Holbeach were found to be in a very dilapidated condition, and it was decided that they should be closed down and that all the gas required in the Holbeach area should be manufactured at the Spalding Works.

It was ultimately decided to lay a 6-in. high-pressure steel main from the Spalding Gas-Works to Holbeach. This project necessitated the crossing of the River Welland. This river is tidal and a considerable volume of coastwise traffic uses the river as far as Spalding. Unfortunately there is only one fixed bridge over this tidal river, and investigation proved that all available parts of this bridge were already occupied by gas and water mains, cables, &c. Incidentally, to go over this bridge would have meant a detour of something like one mile, which in itself was a factor which had to be taken into account in the calculations.

Three Methods Available.

There remained, therefore, three methods available for crossing this river:

(*a*) From the gas-works to a point higher up the river than the existing town bridge (above a point where the river traffic would reach) and crossing by means of a lattice-work carrier which would have been built level with the road on either side of the river.

(*b*) Crossing under the river.

(*c*) Carrying the main over the river.

Proposal (*a*) had to be ruled out on account of cost.

In approaching method (*b*), the Engineer and Manager, Mr. J. Demain (who also holds the position of Water Engineer to the Council), had in mind a scheme which he carried out in 1932. This scheme consisted of the giving of a bulk supply of water to a large adjoining area, which necessitated the laying of two 9-in. water mains under the bed of the river. The banks and bottom of the River Welland consist of quick silt, and those who have had to carry out schemes in connexion with this river know full well how treacherous this sub-soil is.

The Welland Catchment Board insisted that the pipes should be at a depth of 8 ft. 6 in. below the bed of the river—*i.e.*, 6 ft. below O.D. Very severe difficulties were encountered, and two dredgers had to be employed as each tide deposited about 2 ft. depth of silt in the trench already dredged. It should be realized that all this work had to be carried out under about 5 ft. of water. The whole of the work was completed in six weeks; in comparison with this, a similar scheme has just been completed on the same river by a neighbouring authority which took twelve months to complete.

The main objection to carrying out a similar scheme for gas was that of syphons in the river bed. In fact, the only scheme possible would have been to have sunk a vertical shaft on each bank approximately 20 ft. deep and drive a tunnel under the river bed. The two shafts and tunnel would have been brick lined or C.I. sections and the whole of this work would have had to be done under compressed air. The cost would have been exceptionally heavy.

The Final Scheme.

Finally, Mr. Demain prepared a scheme to carry the 6-in. main over the river. This scheme was submitted to the Council and approved. It then had to be submitted to the Mercantile Marine Department of the Board of Trade for their approval—and here the troubles started. Before their consent could be given, information had to be obtained as to the height of masts and funnels of shipping using the waterway, and to their surprise it was found that five years previously a vessel with masts 95 ft. high had used the river. An Engineering Inspector then visited the site, and at last the scheme was approved—subject to the following stipulation:

That an advertisement be inserted in the local Press asking for objections from (*a*) the owners of adjoining property and (*b*) the owners of shipping and barges using the river.

This was done, and no objections were received. Finally, consent had to be obtained from the Welland Catchment Board, the Holland County Council, and the Ministry of Health. All these were duly obtained, and the contract was awarded to Messrs. Callenders Cable and Construction Company. The clearance stipulated by the Mercantile Marine Department of the Board of Trade was 55 ft. above the highest point of the spring tides. The actual clearance given was 56 ft.

The original design, plans, and specifications were amended by Messrs. Callenders to meet wind stress, ice loading, &c. The whole of the sections were fitted together at the shop, then dismantled and heavily galvanized; all bolts were galvanized. This was decided upon to reduce maintenance costs—*i.e.*, scraping and painting. The two towers rest on a reinforced concrete raft, the top of the raft being 5 ft. below ground level. All members below ground level were heavily coated with bitumen and all joints above ground were similarly coated before being bolted together.

The 6-in. pipes were supplied by the Newport and South Wales Tube Company and had welded joints. (The same Company also supplied the eight miles of 6-in. high-pressure main to Holbeach.) The pipes received three coats of red lead paint and two coats of bitumen.

"Mechanical World" Year Book, 1939 Edition*

Many new alloys, ferrous and non-ferrous, have appeared since the time when a few principal types of steel and a table of brass-founders' mixtures served most practical purposes. The transition period was marked in the "Mechanical World" Year Book by a metallurgical study of the new data, but the time has now come when alloyed metals are in widespread use and more concise tabular information of their properties and preparatory treatment is required. In this edition, therefore, a collection of up-to-date information of this kind is presented. General detail revision has been made as usual.

* London: Emmott & Co., Ltd, 28, Bedford Street, Strand, W.C.2. Price, 1s. 6d. net.

Institution of Gas Engineers

Copies of the following recently issued British Standard Specification can be obtained from the Secretary, The Institution of Gas Engineers, 1, Grosvenor Place, S.W. 1, price 2s. each: No. 817—1938.—Cast-Iron Surface Plates and Tables for Inspection and Marking Purposes.

* * *

Members will be welcome at a meeting of the Industrial Lighting Section of the Illuminating Engineering Society at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C. 2, on Dec. 19, 1938, at 6.30 for 7 p.m. A Paper will be read by Mr. T. E. Catten entitled "Light in Relation to Production." Tickets for this meeting can be obtained from the Secretary of the Institution.

Does Benzole Recovery Pay? - - -

The " JOURNAL " has made an analysis of the question of whether or not benzole recovery at gas-works is profitable. We have taken as example a works having continuous vertical retorts and distributing gas of a gross calorific value of 475 B.Th.U. per cu.ft. The gas-making data are those given by Mr. F. B. Richards in his Paper, " Perspective in Carbonizing Costs," to the Eastern Counties Gas Managers' Association in 1934, for a works distributing 15,000 therms, or 3·16 million cu.ft., of 475 B.Th.U. gas per day [" JOURNAL " for Oct. 31, 1934, p. 344, Table 1]. We feel sure that readers will not quarrel with these basic data, which we know are borne out in practice. We take a fixed price for coal, and give the costs of gas manufacture for varying prices of coke when the net revenue for benzole, allowing for operating and capital charges on benzole recovery plant, is 8d. per gallon. On the figures taken it appears that if the extra coke resultant on benzole recovery (3 gallons per ton of coal carbonized) can be sold at a price in excess of 5s. 4d. a ton, then benzole recovery is definitely a paying proposition.

If no change is to be made in the declared calorific value of 475 B.Th.U. per cu.ft., then it is necessary to reduce steaming on the retorts, and, when recovering 3 gallons of crude benzole per ton of coal carbonized, to make 500 B.Th.U. gas; as steaming is reduced the throughput of coal per retort per day can be increased to such an extent that the thermal yield per retort per day remains the same as when steaming down to 475 B.Th.U. *e.g.*:

C.V. of Gas.	475 B.Th.U.	500 B.Th.U.
Throughput per 10 in. of major axis per day, tons	0·097	0·104
Therms per ton	86·0	80·0
Therms per 10 in. of major axis per day	8·3	8·3

Assuming that 3 gallons of benzole are extracted from the gas the loss in therms per ton will be 4·5.

This leaves 75·5 therms per ton of coal to be distributed—*i.e.*, 7·85 therms per 10" major axis per day—and another 6% of retorts will have to be brought into operation to make up for the therms extracted in the benzole plant.

In the accompanying financial statement (Table 1), labour and capital charges in respect of the extra retorts working have been charged, although in most cases the installation of a benzole plant will simply increase the load factor on existing carbonizing plant.

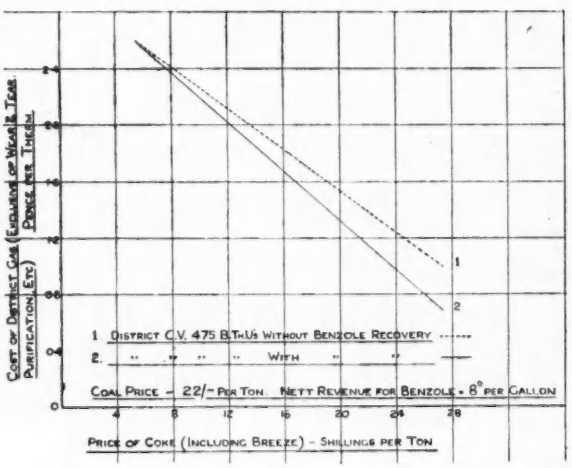

Cost of District Gas (Exclusive of Wear & Tear, Purification, Etc.) Pence per Therm
1 District C.V. 475 B.Th.Us Without Benzole Recovery
2 " " " " With " "
Coal Price - 22/- per Ton. Nett Revenue for Benzole - 8° per Gallon
Price of Coke (Including Breeze) - Shillings per Ton

Fig. 1.

The results in Table 1 show that the most important changes following the installation of a benzole plant are the carbonization of extra coal, the production of extra coke from the extra coal, and also the increase in the yield of surplus coke per ton of coal carbonized due to the reduction in steaming.

The actual quantities per day for a plant distributing 3·16 million cu.ft. of 475 B.Th.U. gas are as follows:

—	Without Benzole Extraction.	With Benzole Extraction.
Coal per day, tons	174·4	198·6
Coke for sale per ton of coal, cwt. ..	10·4	10·9
Coke for sale per day, tons	90·7	108·25
Benzole extracted, galls...	*Nil*	596

Gas engineers are naturally concerned about the price at which the extra coke can be sold, and since the coke price, quite apart from benzole recovery, is the most important determinant of gas manufacture costs, Table 1 has been drawn up for varying prices of coke for sale, assuming a fixed price for coal.

Fig. 1 shows graphically the costs of gas manufacture for varying prices of coke when the net revenue for benzole, allowing all operating and capital charges on benzole recovery plant, is 8d. per gallon.

Graph 1 shows the higher costs without benzole recovery
Graph 2 " " lower " with " "

As the price of coke for sale falls, the financial advantages of benzole recovery diminish until at a point corresponding

Table A.

Selling Price of extra Coke per Ton	Price in Excess of 5s. 4d. per Ton.	Profit to be Credited to Gas Manufacture from Benzole Recovery.	Reduction in Costs of Gas Manufacture
s. d.	s.	s.	d. per Therm.
5 4	*Nil*	*Nil*	*Nil*
8 4	3	52·65	0·042
11 4	6	105·3	0·084
14 4	9	157·95	0·126
17 4	12	210·6	0·168
20 4	15	263·25	0·210
23 4	18	315·9	0·252
26 4	21	368·55	0·294

Table 1.

Making a Final Gas of 475 B.Th.U./Cu.Ft.

Condition.	Without Benzole Recovery.	With Benzole Recovery.
C.V. of gas made, B.Th.U.	475	500
Make per ton of coal, cu.ft.	18,100	16,000
" " " " " therms	86	80
Crude benzole yield per ton of coal, galls. ..	*Nil*	3·0
C.V. of final gas, B.Th.U..	475	475
Make of final gas per ton of coal, cu.ft..	18,100	15,880
" " " " " " therms ..	86	75·5
Dry fuel consumption per ton of coal, cwt. ..	2·96	2·75
Coke for sale per ton of coal, cwt.	10·4	10·9
Tar yield per ton of coal, galls.	13	12
Surplus steam per ton of coal, lb.	925	980
Plant to Produce 15,000 Therms per day for Sale.		
Total coal required per day at 22s., tons.. ..	174·4	198·6
Coke for sale per day, tons	90·7	108·25
Tar per day at 2½d. per gallon, galls.	2,267	2,383
Surplus steam per day at 1s. 8d. per 1,000 lb., lb.	161,000	194,000
Crude benzole per day at a net revenue of 8d. per gallon, galls.	*Nil*	596

Without Benzole Recovery.

Value of Coke per Ton..		27s. 4½d.	24s. 4d.	21s. 3½d.	18s. 3d.	15s. 2½d.	12s. 2d.
Debit—							
Coal	£	191·8	191·8	191·8	191·8	191·8	191·8
Labour	£	8·0	8·0	8·0	8·0	8·0	8·0
Capital	£	23·4	23·4	23·4	23·4	23·4	23·4
Total	£	223·2	223·2	223·2	223·2	223·2	223·2
Credit—							
Coke for sale ..	£	124·2	110·3	96·4	82·8	68·9	55·2
Tar	£	23·6	23·6	23·6	23·6	23·6	23·6
Steam	£	13·4	13·4	13·4	13·4	13·4	13·4
Total	£	161·2	147·3	133·4	119·8	105·9	92·2
Net cost per day	£	62·0	75·9	89·8	103·4	117·3	131·0
„ „ „ therms	d.	**0·992**	**1·215**	**1·437**	**1·655**	**1·877**	**2·096**

With Benzole Recovery.

Value of Coke per Ton..		27s. 4½d.	24s. 4d.	21s. 3½d.	18s. 3d.	15s. 2½d.	12s. 2d.
Debit—							
Coal	£	218·5	218·5	218·5	218·5	218·5	218·5
Labour	£	8·5	8·5	8·5	8·5	8·5	8·5
Capital	£	24·8	24·8	24·8	24·8	24·8	24·8
Total	£	251·8	251·8	251·8	251·8	251·8	251·8
Credit—							
Coke for sale ..	£	148·2	131·7	115·3	98·8	82·3	65·8
Tar	£	24·8	24·8	24·8	24·8	24·8	24·8
Steam	£	16·2	16·2	16·2	16·2	16·2	16·2
Benzole	£	19·9	19·9	19·9	19·9	19·9	19·9
Total	£	209·1	192·6	176·2	159·7	143·2	126·7
Net cost per day	£	42·7	59·2	75·6	92·1	108·6	125·1
„ „ „ therms	d.	**0·683**	**0·947**	**1·210**	**1·474**	**1·737**	**2·002**

to coke at 5s. 4d. per ton the two cost lines intersect. Below this coke price, benzole recovery becomes unprofitable. (See Table 2.)

When the extra coke due to benzole recovery is sold at a price in excess of 5s. 4d., then Table A (p. 836) shows the extent to which benzole recovery contributes to a reduction in cost of gas manufacture. In this particular example there are 17·55 tons of extra coke per day when making 15,000 therms of stripped gas and 596 gallons of benzole.

Table 2.

Distributing 15,000 Therms of 475 B.Th.U. Gas per Day. Net Revenue on Benzole, 8d. per Gallon.

Coke Value per Ton ..		27s. 4½d.	24s. 4d.	21s. 3½d.	18s. 3d.	15s. 2½d.	12s. 2d.
Cost per day of gas without benzole recovery	£	62·0	75·9	89·8	103·4	117·3	131·0
Cost per day with benzole recovery	£	42·7	59·2	75·6	92·1	108·6	125·1
Profit on benzole per day	£	19·3	16·7	14·2	11·3	8·7	5·9
Coke value per day with benzole recovery	£	148·2	131·7	115·3	98·8	82·3	65·8
Coke value per day without benzole recovery	£	124·2	110·3	96·4	82·8	68·9	55·2
Value per day of extra coke at average price (17·55 tons)	£	24·0	21·4	18·9	16·0	13·4	10·6
Profit on benzole per day	£	19·3	16·7	14·2	11·3	8·7	5·9
Revenue required from extra coke to give equal costs of gas production with and without benzole recovery ..	£	4·7	4·7	4·7	4·7	4·7	4·7

Therefore the selling price of extra coke must fall below $\frac{4·7 \times 20}{17·55}$ = 5s. 4d. per ton, before benzole recovery becomes unprofitable.

The Specific Heat, Enthalpy, Entropy, and Dissociation of Technical Gases*

Accurate information as to the specific heats and enthalpies (total heats) of gases at different temperatures is of fundamental importance to a number of industries and, more especially, to the fuel industries. In the past, the values employed were based on experimental determinations and considerable conflict of opinion existed as to the relative accuracy of the results obtained by different workers. Each country was a protagonist of the results obtained by its own investigators, and, in view of the difficulties which the experimental work involved and of the questionable degree of accuracy of some of the results, there was always the fear that any change in the accepted values might be unjustified and might indeed, be a retrograde step.

The rapid developments of atomic physics in recent years have opened up a new field and precise knowledge is now available as to what takes place when energy is imparted to a gas. In brief, the rotational, vibrational, and electronic energy of the molecules is increased in quantum stages and, at any temperature, there is a definite distribution, as regards number, of the molecules in each quantum state. Analysis of the spectroscopic characteristics of a gas by quantum-statistical methods enables the thermal characteristics of the gas to be evaluated and, as a result, theoretical values for specific heats, free energy, and heat content can now be put forward. Statistical methods are also available for the calculation of entropy and the calculated values agree well with those obtained from thermal measurements which have now been extended so nearly to the absolute zero of temperature that extrapolation to zero temperature is possible.

The results of recent experimental determinations of specific heats, made at the National Physical Laboratory and elsewhere with all possible refinements, are available for a few gases and are in full accord with the theoretical values, the reliability of which is, therefore, unchallengeable. The theoretical values have already been widely accepted, and, so far as the more common gases are concerned, are to be found in a number of recent compilations of tables of data.

In view of this, the appearance of a book in which the principles and the methods of calculation involved are set out is very opportune. Dr. Justi, in his monograph, outlines the general theory, discusses each of a large number of gases individually, and, finally, gives comprehensive tables of the specific heats, entropies, and heat contents of all the gases over the range 0° C. to 3,000° C. In addition, the dissociation of gases into simpler molecules, as well as into radicals and atoms, is discussed. This aspect is, of course, of importance in connexion with flame temperature, internal combustion engines, and atomic hydrogen welding. Equilibrium constants and degrees of dissociation are given for all the dissociation reactions over a wide range of temperature.

With use of the new principles it is, moreover, possible to evaluate the effect of pressure on the specific heat of gases, and this aspect, also receives full consideration.

The tables of entropy, specific heat, and heat content are given for the gases in the ideal state in which the gas laws are strictly obeyed—namely, for the condition of zero pressure. Such tables are, in fact, directly suitable for the Gas Industry, which is mainly concerned with gaseous mixtures of which those components which, in the pure state, deviate most markedly from the gas laws, are present in but low concentrations. However, information is also given as to the corrections to be applied for the purpose of reducing the data to a pressure of one atmosphere. A recent Paper by Dr. Justi in Feuerungstechnik embodies complete correction tables which obviate the need for calculations. Incidentally the corrections are almost negligible at all temperatures above atmospheric in the case of the permanent gases and, since the magnitude of the correction rapidly decreases with increasing temperature, the corrections become small at high temperature even in the case of readily condensable gases. Users of the monograph will also find this Paper of help in another direction since it incorporates a list of the errors which exist in the book. That some errors are to be found is not surprising in view of the vast amount of numerical data concerned and of the laborious work involved in their computation. Another useful feature of the Paper is that information is given covering benzene vapour, for which the required spectroscopic data were not available when the book was in course of being written.

Dr. Justi's monograph will prove invaluable to all who have to make thermal calculations in connexion with gases, since, even if they are unable or unwilling to familiarize themselves with the theoretical aspects, they will, none the less, be able to make direct use of the tabulated information which is presented in more complete form than has hitherto been possible.

* Spezifische Wärme, Enthalpie, Entropie, und Dissoziation Technischer Gase, by E. Justi. [Berlin: Julius Springer, 1938. Pp. vi. + 158. Price RM. 18 unbound, RM. 19.80 bound.]

Remote Control of a District Gasholder

by

A. V. WAINWRIGHT,

Shrewsbury Gas Light Company.

Paper to the Midland Junior Gas Association, Nov. 3.

Prior to the erection of a new district gasholder in 1934-35, the total storage capacity at Shrewsbury Gas-Works was 1·054 million cu.ft. Three units stored this gas, Nos. 1, 2, and 3 holders; all are of the two-lift standard-guided type. Table I. gives their capacities and the pressure above atmospheric they create under different conditions.

TABLE I.

Holder Number.	Capacity (Cu.Ft.).			Pressures Produced, In.W.G.	
	Inner Lift.	Outer Lift.	Total.	Uncupped.	Cupped.
1	62,000	67,000	129,000	3·6	6·4
2	85,000	94,000	179,000	3·8	5·6
3	358,000	388,000	746,000	4·5	6·1
	Total capacity ..		1,054,000 normal town pressure 4·3 in.W.G.		

No. 1 is the water gas relief holder; No. 2 the town supply, while No. 3 is the main storage holder supplying No. 2.

By inspection of the above table it will be seen that only Holder No. 3 is capable of delivering gas at or above the normal town pressure when uncupped. While it is possible to supply gas to the town from this holder, the dri-gas plant is by-passed by so doing. This is highly undesirable.

The vital point in these considerations is that the uncupping of Holder No. 3 must be avoided as far as circumstances permit.

With increasing sales and greater variations in hourly and daily outputs the need for additional storage plant arose.

The New Gasholder.

The site is on the district, three-quarters of a mile away from the works.

The general construction of the new holder is shown in fig. 1. It is of the three-lift spirally-guided type built in a steel tank above ground; the whole structure being carried by a reinforced concrete raft.

The gasholder has a delivering capacity of 750,000 cu.ft. at or above a minimum pressure of 6·5 in. W.G. This is the pressure produced by the inner lift. When the middle lift is in operation the holder pressure is 9·4, the outer 12·6.

A notable feature of the gasholder is its common inlet and outlet. In its relation to the district, the holder acts solely as a balance between make and demand, hence only this one pipe was deemed necessary.

The Supply to the Gasholder.

Two methods presented themselves for the supply to the holder. They were:

(1) The laying of a large medium pressure main from the works.

(2) A connexion into a nearby high pressure main and the laying of a short small main to the holder.

There were decided disadvantages to (1):

(*a*) This course would have cost a considerable amount because of its length.

(*b*) The work required to raise its pressure and send the gas to the holder would have meant additional pressure-raising plant, since the general design of the purification plant precluded the raising of the back pressure to the extent the new holder would impose upon it. Otherwise, control from the works would have been simple.

The disadvantages in (2) were:

(*a*) The supply to the holder relied upon the functioning of the existing compressors;

(*b*) Special controlling and supplying devices were required by this system.

Since the cost of laying a small steel main from the high pressure system to the holder was comparatively low, and the work simple, and reliable controlling devices were obtainable, method (2) was adopted.

Apparatus Used.

The layout of connexions, valves, &c., is shown in fig. 2. Referring to this, the inlet supply can enter two ways, from Abbey Foregate and/or Old Coleham. These two supplies

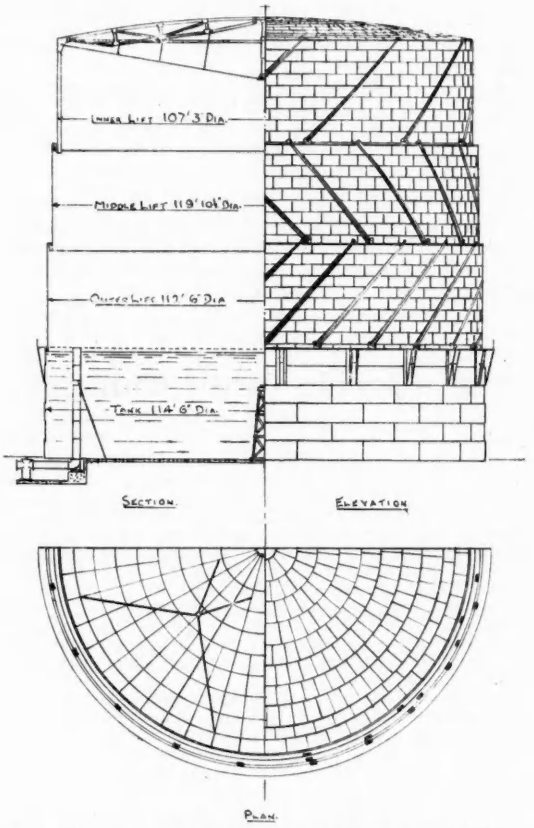


Fig. 1.—Three-Lift Spiral Guided Gasholder in Steel Tank—Capacity ¾ Million Cu.Ft.

are controlled by valves 1 and 2 respectively before merging into one. The gas passing through the common 6-in. main is filtered in a dust box, flows freely through the gasholder-operated stop valve, and is governed by a relief type of governor. The main expanded to 15 in. in the latter appliance, branches into the common inlet and outlet gasholder main, and also into the inlet of the low pressure town supply governor.

By-pass arrangements for all controlling devices are provided and shown in fig 2.

The Dust Trap.—This is simply a cast iron rectangular box containing a gauze filter, the filter sliding into grooves inside the box. The top and bottom of the dust trap are easily removable facilitating the cleaning of the wire gauze filter.

Gasholder-Operated Stop Valve.—To ensure the holder

did not fill to blowing point at any time, a valve operated by the gasholder was installed. It is a double acting valve. The two discs are mounted on a spindle which passes through the top of the valve body and guide-framing to terminate in

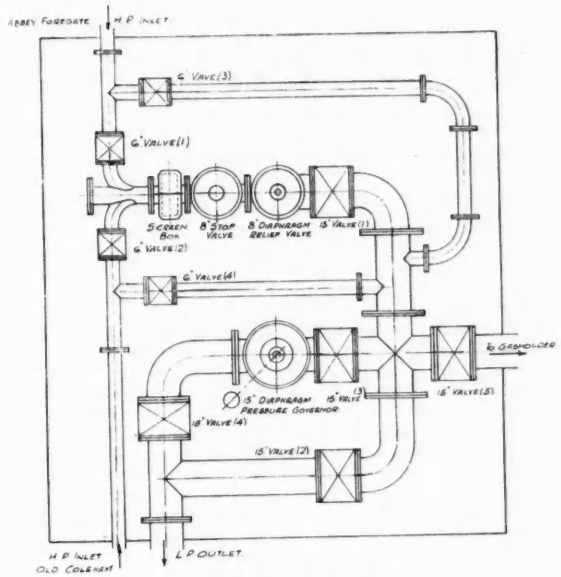


Fig. 2.—Layout of Governor House.

a circular table. The valve is kept open by spring loading, when a weight of 120 lb. is applied at the table, the valve travels 2 in. to close.

The valves each have a leather ring set in them which seats itself on a circular ridge adjacent and concentric to each port. Three wings cast on each valve guide their movements.

Design of the Operating Gear.—To close the stop valve it is necessary to suspend the operating weights above the table and arrange for the holder to lower them when a maximum height is reached.

The arrangement devised is shown in fig. 3.

Since the holder is spirally-guided, it was necessary to mount the section of the operating gear at the holder end on the tank balcony. This part consists of an unequal cranked lever pivoted (at p_2) on a bracket rising from the balcony. The longer arm overhangs on the water side, and passes through a guide to terminate in a cast iron roller. This arm is struck by an angle cleat fastened to the holder, and is counterbalanced against the force of the operating weights. The distance from the pivot p_2 to the sheeting of the outer lift limits the length of the arm. The position of the arm when struck is influenced by this length, for it would be possible, if the lever rested on the balcony edge or near to it, for the striking cleat to miss it. A clip is fixed on the guide rods to maintain it in a minimum safe position.

To the shorter arm is attached the wire rope which runs to the control house.

At the control house the wire rope passes over a guide pulley, and is attached to the top corner of a right-angled triangular plate pivoted (at p_1) in a frame. The operating weights are hung from the bottom corner of the plate by a separate length of wire rope.

When devising this arrangement it was considered desirable to have a rise in gasholder height, after first striking the lever, of more than the 2 in. travel of the valve. Hence, levers of unequal arms were decided upon. The dimensions of the levers were fixed, and the counterbalance weight required was calculated.

Increase in Gasholder Height During Operation.

To obtain the displacement of the operating gear in relation to the gasholder, the movements were set out on paper to a large scale.

To allow for rope stretch the weights were suspended $\frac{1}{4}$ in. above the table; this gives a $2\frac{1}{4}$ in. travel for the weights to close the valve and displaces the wire rope from the weights to the triangular plate to the same extent.

Referring to fig. 4, it will be seen a $3\frac{1}{8}$ in. displacement results in the section of wire rope running to the holder. The shorter arm of the cranked lever moves accordingly giving a vertical rise of $11\frac{1}{2}$ in. to the longer arm. This rise corresponds to the required movement of the holder to close the stop-valve completely.

Position of Striking Cleat.—The theoretical height of the striking cleat is the vertical travel of the roller on the operating level *plus* the distance the cleat is from the water level when it first strikes the lever, *plus* the gasholder pressure. This equals 2 ft. $3\frac{1}{4}$ in.

However, changes in the atmospheric conditions needed to be taken into account. Although maximum storage is desirable, there was the possibility of further inflation after filling had been cut off requiring a cleat position relatively higher up the holder. But an increase in the height of the holder above cut off point might be sufficient to allow the end of the lever to slip over the edge of the cleat. Then it would be trapped underneath the cleat when the holder descended.

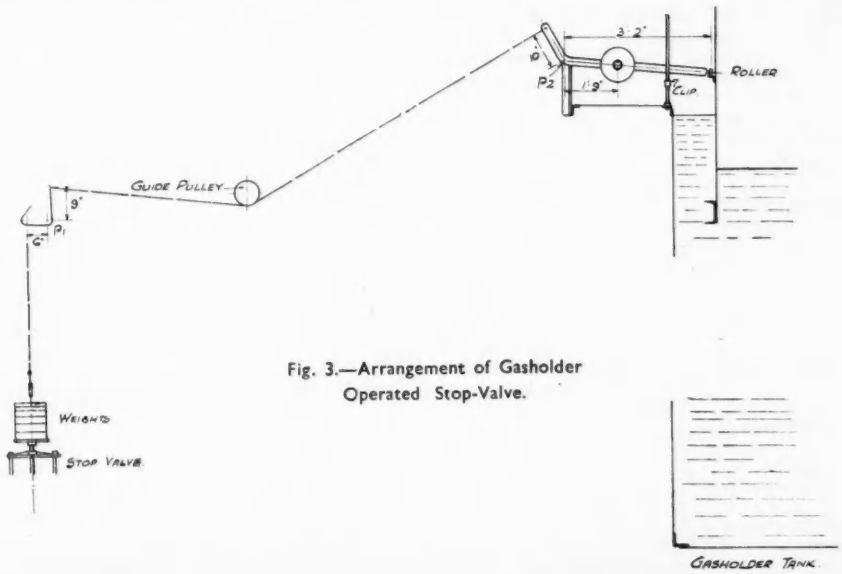


Fig. 3.—Arrangement of Gasholder Operated Stop-Valve.

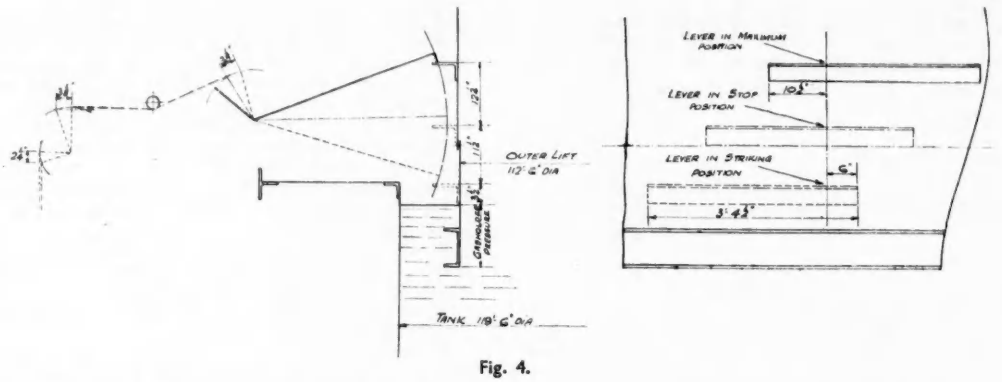


Fig. 4.

Hence, should further inflation occur after the lever has reached its top position, the holder should unseal before this danger point is reached. It was arranged for this to happen when the roller, in the maximum position, was in the same vertical line as it was when struck first by the ascending cleat.

Actually, then, the cleat was fixed at a distance of 3 ft. 3¼ in. up from the underside of the bottom curb. This distance consists of maximum lever displacement (1 ft. 11¼ in.), *plus* the distance between tank water level and the roller on the cranked lever (3½ in.) and the gasholder pressure (12½ in.).

Another aspect of the position of the cleat was its movement relative to the cranked lever. In rising, the cleat also moves horizontally away, hence the roller on the lever. The angle so described is 45°, so that the horizontal travel is equal to the vertical. This gives a minimum length of 1 ft. 11¼ in. for the cleat—say, 2 ft. A 6 in. clearance was allowed at the one end where contact is first made, and 10½ in. at the other, making a total length for the cleat of 3 ft. 4½ in.

This operating gear was tried out after installation, and was found satisfactory.

The Diaphragm Relief Governor.—The apparatus consists essentially of a double-acting valve operated by a spindle fixed in a diaphragm.

The inflating and deflating of the diaphragm is governed by a spring loaded pilot governor. A 1 in. connexion is made on the inlet of the relief governor; this branches into the pilot governor, and also through a needle valve, to the underside of the diaphragm. The outlet of the pilot governor is connected to the top of the relief governor. These two connexions above and below the diaphragm constitute the control on the relief governor.

To enable the pilot governor to operate, gas from the top side of the diaphragm "bleeds" through a needle valve, in a 1 in. pipe, to the outlet of the governor.

Action of the Relief Governor.—The pilot is set to give a definite minimum opening pressure on the inlet to the relief governor. Below this pressure the governor remains closed. When the inlet pressure is increased the pilot governor operates to open the relief governor. A reduction in inlet pressure brings about a reversal of these actions.

Low Pressure Town Supply Governor.—This governor is an orthodox diaphragm governor. A double-acting valve attached to a spindle is operated by a diaphragm. The weight of the valve spindle is counterbalanced by weights, on a hanger, at one end of a double lever pivoted on the governor body. The other end of the lever is linked to the valve spindle.

The required pressure is obtained by loading the valve spindle with weights.

The Distance Height Indicator.

A knowledge of the contents of a gasholder is an essential factor in its use. The height is usually obtained by observing the position of the holder relative to the water level and converted to volume by a table of conversions. However, it was intended that there should be no attendant at the new gasholder, hence it was essential to install an instrument which would give the required reading on an indicator at the works.

It consists essentially of two electrical circuits in which different resistances are obtained in accordance with movements of the gasholder by mechanical means. The various current values so obtained are measured on ammeters graduated, in the case of the primary circuit, in units of 3 in.; in units of 10 ft. in the secondary.

A battery of five 2·2 volt wet cells provides the electricity.

It is arranged that when the height of the holder is zero, the circuits contain the maximum resistances. As the holder rises, resistances are rejected; accordingly, with consequent increase in current, clockwise deflections of the ammeters' pointers result.

A wiring diagram is shown in fig. 5, the mechanical details of the rheostats in fig. 6, and the operating gear in fig. 7.

There are three parts to the indicator:

(1) A kiosk at the holder site with
(2) the operating gear from the holder, and
(3) an instrument panel, with the batteries, mounted on the wall of the compressor house at the works.

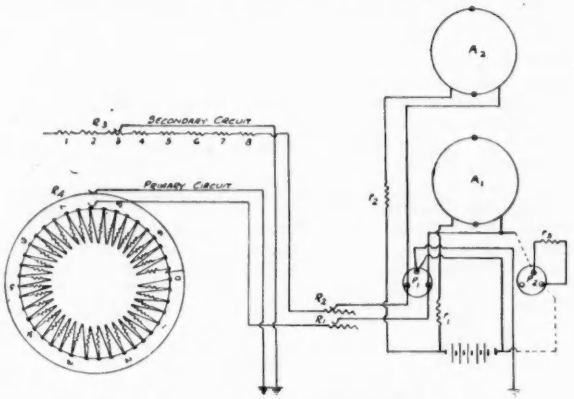


Fig. 5.—Wiring Diagram of Distance Height Indicator.

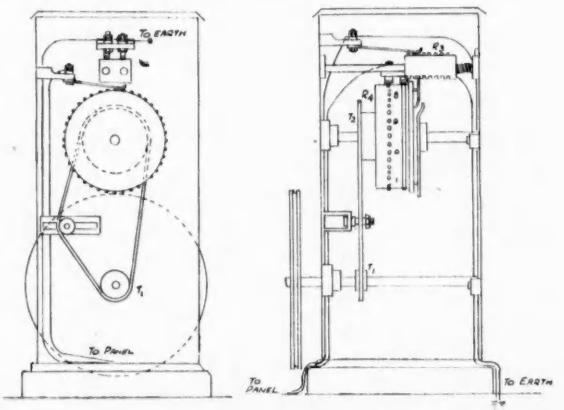


Fig. 6.—Details of Kiosk.

Inside the kiosk are two rheostats. The one in the primary circuit is cylindrical (R_1), and contains 39 equal resistances each representing 3 in. of gasholder height; this gives it a range of zero to 9 ft. 9 in. The other is in the secondary circuit (R_3), and is a rectangular box containing eight equal resistances representing a range of zero to 80 ft. in 10 ft. units.

The cylindrical rheostat is driven by a chain from the toothed wheel T_1 to the toothed wheel T_2; the source of power being a wire rope attached to the holder. When the holder rises the system moves clockwise.

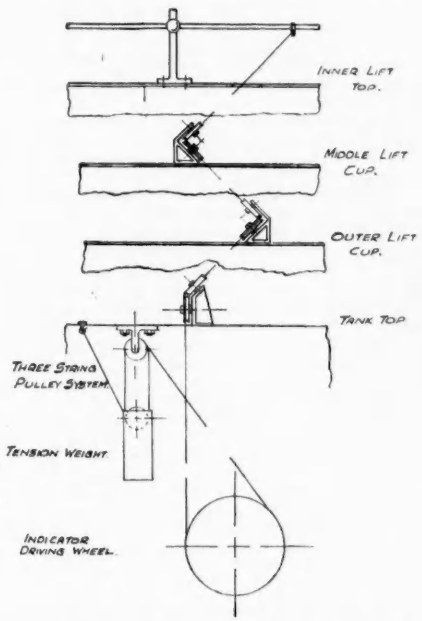


Fig. 7—Operating Gear for Height Indicator.

A complete revolution of the rheostat R_4 will move the finger of ammeter A_1 through the maximum deflection of 9 ft. 9 in. and return it to zero.

A steel ring fastened on the cylindrical rheostat engages in a rack R_3, so that with the completion of the first clockwise revolution by R_4 from zero, the first section of the rheostat R_3 is removed from the secondary circuit and the finger on dial A_2 moves from zero to 10. Further rotation of R_4 brings the reading into the "'teens," thence to the "twenties," and so on.

Two lines from the kiosk, one from each rheostat, are brought overhead; the other two are earth returns. The overhead lines are brought to the socket of a three-pin plug in P_1 on the panel, through the voltage compensating rheostats R_1 and R_2, thence to the negative side of the ammeters through the plug connexions.

The positive terminals of the ammeters are connected to the wet cells through the permanent resistances r_1 and r_2.

The instrument works on a constant voltage basis. The voltage can be tested by plugging in at P_2 (the circuit is shown dotted), the lower ammeter A_1 acting as a voltmeter. Loss of pressure within a certain limit can be compensated by the rheostats R_1 and R_2.

The operating medium is a wire rope attached at one end to the handrailing of the crown of the holder, and at the other to a tension weight suspended from the tank balcony. The rope passes around a grooved wheel keyed on to the same shaft as the toothed wheel T_1. Since the lifts of the holder move in a direction at 45° to the vertical and in opposite directions, alternately, a system of guide pulleys was necessary.

The whole apparatus is trouble-free; only needs attention to the cleanliness of the contacts, periodically, and checking with a tape measure in case of alterations in rope length.

Instruments in the Control House.

The control house is equipped with three pressure recorders connected to:

(1) The low pressure town supply system.
(2) The gasholder common inlet and outlet main, and
(3) The inlet of the relief governor.

The Supply to the Gasholder.

The compressor is controlled by a constant pressure steam regulator loaded to maintain a pressure of 2·0 lb. per sq.in. on the outlet of the compressor. Hence, to pass gas through the relief valve, it would be necessary to arrange for it to open at a pressure less than 2·0. However, when a supply of gas to the holder was not required, a fresh setting bringing the opening pressure above 2·0 lb. per sq.in. would be necessary. This system would have required an attendant.

Therefore, since the valve would close under certain conditions of pressure, and the amount of gas passing is determined by the pressure differential between compressor outlet and relief valve inlet, the opening pressure on the relief valve was made constant and the pressure at the compressor outlet varied above and below it. It was decided to make this opening pressure 2·1 lb. per sq.in. to avoid reducing the compressor outlet pressure below 2·0.

Now all that remains to be done to supply the holder is to increase the compressor outlet pressure above 2·1 lb. per sq.in., such increase being proportional to the desired rate of gas supply. To stop the supply, the compressor outlet pressure is reduced to 2·0 lb. per sq.in. again.

The supply to the holder is limited by the maximum speed of the compressor; therefore most of the supplying is done during times of small demand on the high pressure system.

Stock Arrangements.

The introduction of the new gasholder necessitated a revision in the method of balancing the gas make and stock against the demand. Previously, the policy was to make as nearly as possible the estimated requirements during the 24 hours of each day for that same time. The stock in the town supply holder was maintained at 164,000 ± 10,000 cu.ft. and could be considered a constant, which left only the main storage gasholder to offset the variations between gas made and sent out hourly and for the complete day. No definite arrangement of stock in any of the holders could be made. Now that the new gasholder shares the variations with Holder No. 3, arrangements are made for the latter to work between defined limits and be at a certain height by 6 p.m.—that is, stocktaking time.

The gas compressor runs only between 7 a.m. and 11 p.m., hence all feeding of the district gasholder has to be done during this time. This means that when the compressor stops for the night there must have been sufficient gas supplied to this gasholder to leave room in the works gasholders for the stock made between 11 p.m. and 7 a.m. Or conversely, sufficient must be released from the new holder during the day to prevent No. 3 gasholder becoming uncupped. Thus, the content of the district gasholder is governed by the stock held at the works.

Modification of the stock in the district gasholder is accomplished by a combination of pressure conditions.

(1) By varying the pressure on the outlet of the compressor, gas can either be delivered (or delivery rate increased) to the holder, or such supply terminated.

When the holder is being supplied to increase its stock not only must the compressor deliver the gas required for that purpose, but must compensate for consumers' requirements as well.

When the holder stock is being reduced, the compressor outlet pressure is reduced to close the diaphragm relief valve. This stops a direct supply from high pressure system to low pressure system through the relief valve and low pressure governor. Therefore, all outgoing gas is from the gasholder, giving ease in the reduction of the stock.

(2) The quantity of gas passing from the control house into the low pressure mains at any time depends upon the difference between the pressure in the supply system and the pressure at the immediate outlet of the low pressure governor installed in the control house. Therefore, if the pressure is raised in the supply mains, less gas leaves the district holder. This is accomplished by increasing the normal pressure maintained at the outlet of the governors at the works.

Conversely, a reduction in the pressure at the governors on the works increases the rate of gas from the district holder to the supply mains.

Maintenance of the Gasholder and Control Apparatus.

Daily.—Thawing ice-bound dips and tank in frosty weather.

Weekly.—Superficial examination of the gasholder. Syphon tried. The cover plates of the diaphragm relief valve are removed, the valve guides oiled, and the valve worked by hand with the aid of a lever.

The stop valve is tried by lifting the lever at the gasholder, the wire rope is examined for stretch, and all pivots oiled.

Contacts on the distance height indicator are cleaned and the accumulators tested for voltage.

Monthly.—Gasholder carriages are oiled.

All valves in the control house are worked.

The needle valves on the relief valve are examined for gum deposits and cleaned, if necessary.

The diaphragms in the relief valve and low pressure governor are oiled.

Three-monthly.—Quarterly gasholder inspection.

The dust box is examined and emptied if necessary.

Yearly.—Annual gasholder inspection.

A complete coat of paint is given.

The steam boiler used for ice-thawing is cleaned and examined.

With this maintenance routine the gasholder gives no trouble and the works control is practically perfect.

In conclusion, I should like to thank my Chief for the opportunities and help given in compiling this Paper. Also my colleagues on the Technical Staff for checking through the manuscript. Lastly, H. C. Widlake, Esq., for permission to describe the distance height indicator.

Discussion.

The PRESIDENT (Mr. A. W. Attwood) announced that the Milbourne Medal had been awarded to Mr. W. L. Howe, of Nottingham Gas Department, for his Paper entitled "Gas and the Filtration and Heating of Swimming Pools," read before the Association during the previous session.

In regard to Mr. Wainwright's Paper, the subject, he said, was one which had gained in importance in recent years in view of the fact that gas-works were becoming overcrowded and, in consequence, gasholders had to be built some distance away. With the question of Air Raid Precautions so much to the fore, the tendency would, no doubt, be to erect new holders away from the works.

Mr. W. N. SMIRLES (Birmingham), in proposing a vote of thanks to the Author, said he thought the Paper would have provided interest for all those present whether they had anything to do with the working of gasholders or not. Where a holder was situated away from the gas-works it was very necessary that the control should be foolproof.

Mr. G. E. STEVENSON (Long Eaton) said he considered the subject was one to which the Gas Industry had not paid sufficient attention in the past, and he thought the system was one which effected considerable saving in labour costs.

Mr. S. BROCKBANK (Walsall) remarked that while there was something to be said for erecting a holder on the district from an A.R.P. point of view, he considered that in all other respects it was an advantage to have the holder on the works.

Mr. C. H. WOODFINE (Wellington) referred to the many amalgamations which had taken place during the past few years, and said that the advent of holding companies had resulted in the closing down of numbers of small works, the gasholders attached to which were being utilized for storage purposes. From this point of view he considered the Paper was of great interest.

Replying to a number of questions raised, Mr. WAINWRIGHT said that practically no trouble had been experienced with the distance height indicator although there was a little fluctuation at times. At Shrewsbury they had two works but neither could accommodate the holder referred to, and it was not proposed to transfer the works to the holder site, which was situated between two railways. With regard to the question of making control more automatic, he said that this question did not arise at Shrewsbury in view of the fact that they had a man at the holder station. The height indicator was frequently read and this instrument was relied upon to show the position of the holder.

THE INSTALLATION OF Gas and Steam Equipment in a Municipal Kitchen

by F. BELL, of Liverpool

From a Paper before the Manchester and District Junior Gas Association on Nov. 16.

The installation by a gas company of gas and steam equipment on a large scale is rather unusual, and therefore some explanation is necessary.

The tenders asked for by the Liverpool Corporation were for complete cooking equipment to supply mid-day meals to the necessitous children of the city; the food cooked at this central kitchen to be distributed to the various schools by motor vans.

Our first scheme as a Company was to put forward a kitchen with independent units of gas-heated roasting ovens, pastry ovens, food steamers, and food boilers. We found however, that the Corporation authorities had, and I think rightly too, favoured the use of steam for the food boilers, steamers, and hot cupboards. We had, therefore, to put forward our case for gas-fired steam boilers, and finally, when asked to submit our scheme, suggest such apparatus and arrangements as would give a clean and easily operated kitchen with the minimum of labour and attention.

Ranges, Roasting Ovens, and Confectioners' Ovens.

It was intended that this kitchen should be modern, clean, and easy to operate. Solid fuel fired ranges therefore did not receive sympathetic consideration. Electricity, however, was seriously considered, and it was this fuel which proved to be our biggest competitor. We therefore enumerated certain points which showed gas-fired apparatus to advantage over electrical equipment.

(i) Cost. The initial cost of electrical apparatus is generally higher than that of comparable gas apparatus. The cost of installing electrical apparatus is generally higher.

(ii) Adaptability. With modern heat regulators and controls, there is little to choose between gas and electric ovens. On the hotplate however, gas has a distinct advantage, as the amount of heat can be regulated to any degree desired. This flexibility is absent from the majority of electric hotplates since usually only three controls are available.

(iii) Speed of Operation. This is most important in such a kitchen and here the gas cooker has a very definite advantage. A gas hotplate burner gives full heat instantly, whereas with electric elements some time must elapse before heat is transferred to the article being heated. Tests show that the electric hotplate takes from 11% to 200% more time to perform a number of general cooking operations. Similarly, with the electric oven depending upon the temperature required, it takes 200% to 500% more time to heat up than a gas oven.

(iv) Maintenance Costs. For gas apparatus these are par-

ticularly low and continued use does not materially affect the general performance. The elements of an electrical apparatus decrease in efficiency and finally burn out and require renewal.

(v) Reliability. Failures of gas supply or gas burners are very rare, whereas complete failure of electric supply is not an uncommon occurrence. Electric elements may fail at any moment whilst in use and the probability is that the failure is not noticed until some time after. The elements have then to be replaced.

(vi) Costs. Many cases could be quoted where gas has replaced electricity and the running costs have been markedly reduced. In Liverpool, as with many other undertakings, electricity is offered as ½d. per unit, *plus* a standing charge. The "change overs" have shown us that gas at 7½d. per therm is cheaper than electricity at ½d. per unit clear of standing charge. In this instance, the electricity would have been at ½d. per unit, whereas the gas will average out at about 6·8d. per therm.

The aforementioned points were raised in discussion and gas-heated apparatus was chosen.

Choice of Plant.

(i) *Steam Raising Plant.*

As a result of previous experience with the "Sinuflo" vertical gas-fired boiler, which had given every satisfaction, we decided again to recommend the use of this type of boiler.

The site for the boilers was in a room adjacent to the main kitchen, from which access for the necessary attention would be an easy matter. In this case, therefore, the type of controls and accessories to be fixed to the boilers needed careful consideration. Automatic pressure control on such boilers is essential, but, for the principal reason of additional first cost, automatic water feed was not suggested. Provision for the addition of this apparatus was made, and for the present, hand operated injectors were installed. At least one male operative will be employed in the kitchen to operate the lifting gear for the heavy vegetable baskets, so it was concluded that his duties would also include that of boiler attendant. To reduce to a minimum any chance of damage to the boilers due to lack of water, a low-water cut-off device of the Drayton type was fitted. Now the steam boilers which were installed were of such a size as to work the whole of the steam plant, at a maximum demand together, if necessary. It was, however, highly improbable that such an occasion would arise, so we could confidently expect that the boilers would be on by-pass consumption quite frequently. The fitting of automatic flue damper controls, which closed the flue apparatus down to a fixed minimum when the boilers were on by-pass, were considered to be essential accessories. The type used was made to the specification of the Gas Light and Coke Company.

(ii) *Hot Water Plant.*

For the storage of hot water, especially in soft water districts, copper tanks are essential. Our choice was therefore for a copper calorifier with internal copper cylinder for the primary heating, which was connected up to an "Ideal" gas-fired boiler. For gas boilers of the size required for this duty it has been found that the "Ideal" is satisfactory. They are simple to operate and maintain, and the thermostat standard to the boilers is simple and positive in action.

(iii) *Food Boiling Pans.*

For large food cooking installations, small boiling pans are not desirable. They occupy too much space for their capacity, and multiply the number of pans to fill and watch per unit of food cooked. Pans of not less than 60 gallons capacity should be chosen. In our case, the type selected was the 80-gallon size for all except one, which was 100 gallons. The insides of the pans should be cast iron, bower-barffed, or of stainless steel. The cast iron pans are satisfactory for meat boiling, but should "greens" be boiled in these pans it is advisable to work the pans in a cycle, boiling "greens" one day and meat the next. This tends to keep a film of grease on the sides of the pans, and so protects them from corrosion caused by the soluble constituents of the "greens." Stainless steel containers are especially good for soup boiling, so a proportion of the boiling pans installed were fitted with stainless steel inner pans.

The pans to be used for "greens" were provided with wire baskets for the easy handling of the vegetables.

The weights of the baskets to fit 80-gallon pans when full with food, however, are such that lifting tackle for them is necessary. The boiling pans and lifting tackle were made by a local firm.

Large pans should have run-off taps provided, and so, in our specification to the makers, we asked for 1½-in. gunmetal taps with cleaning plug and perforated protection plate to the run-off on the inside of the pan.

(iv) *Steam Ovens.*

Two compartment ovens for a working pressure of 5 lb. per sq. in. were chosen. The doors of this type are made steam tight by being drawn up on to asbestos packing in the oven frame by means of two screw-down catches. The lugs on the doors are such that the catches cannot be freed to open the doors until they have been screwed open for a considerable way. This ensures that the steam pressure inside the oven is released before the door is fully opened. The ovens are under separate steam control.

(v) *Pastry Ovens.*

Having had considerable and satisfactory experience with the "Portway" ovens, we had no hesitation in suggesting this type. The twin No. 3 ovens were chosen as being of suitable size, each oven having five shelves 33 in. × 20 in.

(vi) *Ranges and Roasting Ovens.*

In a kitchen of this type, hotplate work is kept to a minimum, and food is cooked which requires as little hotplate-work as possible. Only one range with hotplate was provided, and this was an island range with solid top hotplate. This hotplate is designed for heavy duty, while the drop-down doors of the ovens serve as useful shelves on to which heavy joints, withdrawn from the ovens, can rest for inspection.

For the heavy roasting duties of the kitchen, the "Royal" ovens with double doors were selected.

(vii) *Bread Baking Oven.*

One very satisfactory gas-fired "patent" baking oven is the "Cox," and as a result of our own experience with it, we again suggested this type of oven in its double-decked form.

(viii) *Custard and Sauce Boiler.*

Experience with the "Alcalda" milk boiler for the ice-cream industry had proved it to be in every way satisfactory. It has its own self-contained steam generator and steam jacket with automatic pressure control, safety valve and gauges for water level and steam pressure. A boiler with both stainless pan and outer casing was chosen.

(ix) *Hot Closet.*

As steam was available whenever it would be necessary to keep food warm, a steam-heated hot-closet taking steam at 15 lb. per sq.in. was chosen.

The Capacity of Plant Required.

Up to the time of opening this kitchen, all mid-day meals for necessitous children had taken the form of soups and a vegetable. But the idea of the officials was to have a new central kitchen capable of cooking a variety of dishes so that the children could have a menu of more solid foods capable of giving the correct nourishment.

Examples of the proposed menus are as follows:

SUMMER MENUS.

Roast mutton	Sausages	Beef
Potatoes	Potatoes	Roast potatoes
Fruit, tart, custard	Rice pudding	Steamed pudding

WINTER MENUS.

Steak pie	Beef	Mutton
Potatoes	Butter beans	Turnip
Cauliflower	Potatoes	Potatoes
Prunes	Fruit	Apple pudding

The cooking apparatus, therefore, had to be capable of cooking the food necessary for 10,000 children in the period of time before 11.0 a.m., this time being the latest that the last motor van could leave the kitchen and have its supplies of food at the various feeding Centres in time for the mid-day meal.

The sizes of the various types of cooking apparatus were determined as follows:

1. *Roasting Ovens.*

The quantity of meat allowable per child is 3 oz. Since the roasting of the meat is a long operation, and cannot be duplicated in any one morning's procedure, the oven capacity had to be sufficient to take the whole of the meat at once. The total meat for the 10,000 children would be 30,000 oz. or 1,875 lb., and since 1 cu.ft. of oven space will take 16 lb. of meat, 117 cu.ft. of oven capacity would be required.

The island range was first chosen. It had four ovens, 30 in. × 24 in. × 15½ in., giving 6·45 cu.ft. per oven, or 25·8 cu.ft. for the range. This left 91·2 cu.ft. still to be provided, and we decided on a large type of double-doored roasting oven. These had internal measurements of 36 in. × 30 in. × 46 in., and a capacity of 28·7 cu.ft. each. Three ovens would not meet our requirements, but four gave as satisfactory capacity without the need for excessive packing.

2. *Steam Ovens.*

The steamed puddings were to be made in cylindrical containers about 3 in. diameter and 13 in. long, the portion per child being approximately a 1 in. slice. The steaming ovens chosen were the 24 in. × 14 in. × 30 in. high type, and these will take 48 pudding containers or provide portions for 48 × 13 = 624 children. A fraction over 16 such ovens would be necessary for 10,000 portions, but seeing that 16 could cater for 9,984 children, this number was considered satisfactory, and was provided by eight of the two-compartment type.

These same ovens can also be used for potatoes, turnips, or carrots when not in use for puddings. One cu.ft. of oven or boiler space will take 44 lb. of potatoes, and since these ovens have a tray capacity of 4·7 cu.ft., 206 lb. can be cooked in each oven. Each child is allowed a maximum of 0·35 lb. of potatoes per meal (*i.e.*, 35 lb. per 100 children), and therefore each oven will cook for 600 children, or the 16 ovens for 9,600 children. Since potatoes only take some 20 min. to cook by pressure steam, it would be an easy matter to arrange for a second batch in one of the ovens, the first batch being used for the early loads of meals to the most distant schools, and the second batch for the latest consignments near to the kitchen.

3. *Boiling Pans.*

The boiling pans are necessary for the cooking of green vegetables, soups and potatoes and root vegetables when space in the steam ovens is taken up by puddings. On large boilers of this type where you can pack green vegetables an allowance of 4 lb. per gallon is made. Considering that each child is supplied with 3 oz. of green vegetables, then 10,000 children would require 1,875 lb. or an approximate boiler requirement of 470 gallons. We allowed five boilers each of 80 gallons capacity for this work, with the one 100-gallon boiler to act in a "floating" capacity and take the excess from any particular operation.

For potato boiling, as with steaming, you can allow 44 lb. per cu.ft. These boilers held 80 gallons at a level 2 in. from the top, and therefore calculations can be based on a full 80 gallons in each case. Each boiler will have a capacity of 12·8 cu.ft., or take 560 lb. of potatoes, sufficient for 1,600 children. Five 80-gallon boilers will provide for over 8,000 children. The same calculation is made on the 100-gallon boiler which has a capacity of 16 cu.ft., or 704 lb. of potatoes, sufficient for just over 2,000 children. Then five 80-gallon and one 100-gallon boilers give you your "potato" capacity for 10,000 children.

4. *Pastry Ovens.*

These ovens were for the cooking of fruit tarts, stewed fruit, and similar operations. When catering for such a large number as 10,000, the tarts are made with some three or four times the usual thickness of fruit. This gives excess fruit suitable for some two or three other portions. The pastry for these fruit portions is prepared separately, either beforehand, and warmed in the hotcloset, or at the same time in the Cox oven.

Each child's fruit tart portion is approximately 2 in. square. "Portway" ovens were chosen with trays 33 in. × 20 in., which took tart tins some 30 in. × 18 in. × 2½ in. deep. Each tin can provide 60 children with pastry and fruit, and another 120 to 130 with the fruit portion. We therefore chose six double No. 3 "Portway" ovens, having 60 trays, to provide the pastry and fruit portion for 3,600 children, and the fruit portion only for another 7,200.

5. *Steam Boilers.*

Having chosen the number and size of our steam cooking equipment, it now remained to choose the size of steam boiler or boilers.

Below is detailed the maximum and average steam requirements from and at 212° F. for the steam cooking equipment to be installed.

—	Maximum Steam Requirements, Lb./Hour.	Average Steam Requirements, Lb./Hour.
80 gallon steam jacketed boilers	170	150
100 " " " "	190	165
2-compartment steam ovens, 14 in. × 24 in. × 30 in.	120	75
Hotcloset, 12 ft. × 2 ft. 6 in.	70	60

The "maximum steam requirements" apply to the apparatus while they are in the early heating up period. For food boilers it is applicable until near the time when the contents themselves are boiling, while with the steamers it only applies until they are full of steam; thereafter their requirements are low.

On this basis, therefore, it was considered that if we arrived at the total maximum steam requirements for all the plant and took this figure as the requirements for our steam boilers, then we should have a satisfactory working reserve. It must be appreciated that it would be impossible to have all the apparatus taking their "maximum steam requirements" at the same time.

The steam boiler capacities should therefore be able to supply the quantity of steam detailed below:

Ten 80-gallon boilers each requiring 170 lb. of steam ..	=	1,700 lb./hr.
One 100-gallon boiler requiring 190 lb. of steam ..	=	190 lb./hr.
Eight steam ovens, each requiring 122 lb. of steam ..	=	960 lb./hr.
One hotcloset, requiring 70 lb. of steam	=	70 lb./hr.
Total amount of steam required	=	2,920 lb./hr.

Seeing that the "load" on this kitchen would be almost proportional to trade conditions in the city, since it was for the feeding of poor children, it was thought advisable to install two boilers, one with a capacity of one-third and the other with a capacity of two-thirds of the maximum kitchen requirements.

The boilers chosen therefore were:

One No. 10C boiler, capacity..	2,065 lb. from and at 212° F.
One No. 8C boiler, capacity..	1,158 lb. from and at 212° F.
Total	3,223 lb. from and at 212° F.

6. *Hot Water Supply.*

The hot water required in this installation was for general kitchen uses in addition to the washing of all containers which had been used for the transport of the cooked food. None of the usual rules could be used on this occasion for determining the amount of hot water required by the kitchen or for the size of the storage required. However, from experience gained at other smaller kitchens, it was decided to have a storage of 600 gallons of hot water with a supply at the rate of 300 gallons per hour.

From the system of food distribution adopted, it will readily be noted that the bulk of the washing of utensils would be in the afternoon after the vans had collected them from the various feeding centres.

The steam boilers would be closed down at noon, so it was considered uneconomical to keep even one boiler working just to supply hot water. It was therefore decided to install an independent hot water system with a gas-fired hot water boiler. At the time of this installation, the Gas Industry did not, to my knowledge, possess a large bower-barffed hot water circulating boiler, so it was decided to provide a water to water calorifier heated by an "Ideal" gas-fired boiler. The calorifier chosen was made throughout of copper and had a capacity in the secondary cylinder of 600 gallons. The heating surface or primary of the calorifier was in the form of a copper cylinder with a transmission of 300,000 B.Th.U. per hour when the mean temperature of the primary flow water was 160° F. and the secondary water at a mean temperature of 100° F. The Ideal gas boiler chosen for the heating of the primary circuit was the No. 2GB.7 with a rated output of 297,000 B.Th.U. per hour on

470 B.Th.U. gas, or 301,000 B.Th.U. per hour on Liverpool gas. This plant would therefore raise the 600 gallons in the calorifier from (say) a mean cold water temperature of 50° F. to 150° F. in two hours and after that deliver water raised through 100° F. at the rate of 300 gallons per hour.

7. *Baking Oven.*

The size of the baking oven to be provided was somewhat difficult to determine as it was not certain whether the kitchen would bake its own bread supplies or not. The size of the two-deck "Cox" oven at 6 ft. × 4 ft. was considered by our customers to meet their requirements.

8. *Small Gas-heated Steamer.*

A small steamer of the "Rotapan" type was provided for staff use.

9. *Radiators for Heating.*

The main kitchen, of course, would receive ample heating, but the offices and ante-rooms would require heat. Flueless heaters of a size suitable to the rooms to be heated were installed.

Installation of Gas Equipment.

The main gas supply to serve the whole of the Food Centre was "teed" off an 8 in. main in the road on the east side of the building. It was at this end of the building that the boiler house was situated, so an 8 in. service was brought to the meter house butting on to the boiler house. As the 8 in. service entered the meter house, an 8 in. × 4 in. tee was fixed. One branch, an 8 in., was taken to a 12,000 H.C. meter to supply the steam boilers and hot water boiler, and the other branch, a 4 in., was taken to a 3,000 H.C. meter to supply all other gas apparatus.

Considering the importance of maintaining an uninterrupted supply of gas to this installation, we thought it advisable to fix a by-pass valve to each meter. From the 12,000 H.C. meter was taken an 8 in. outlet supply for the steam and hot water boilers.

On all three boilers were fitted independent by-passes. In the case of the steam boilers, it took the form of a gas supply in ¾ in. pipe taken from the main gas supply before the main cock and connected to the burner manifold after the automatic control valve.

The by-pass on the hot water boiler consisted of a ½ in. gas supply taken out of the main supply before the main cock. It was fitted with a cock with loose key and terminated in two by-pass jets in different sections of the boiler near the main flames. This by-pass is never turned off, and therefore there can be no chance of an accident due to the turning on of the main gas supply before the insertion of a light.

The gas supply for other gas equipment was taken from the 3,000 H.C. meter in 4 in. diameter pipe and run through the boiler house into the subway around the kitchen. At this point three connexions were taken out and run along the subways to supply the various gas equipment.

The main kitchen is of one story construction with a lofty single span roof supported by open trusses and terminating in a "lantern light" running the full length of the ridge, having opening ventilator windows on both sides, operated by opening gear. This explanation is necessary so as to give some reason for the lack of external flues to any of the gas appliances in the kitchen. The whole of the appliances discharged their products of combustion, above head level, into the kitchen, and from there were finally vented to atmosphere through the "lantern light" ventilators. The installation of a positive ventilation system with hoods and ducting for a kitchen of this size would necessarily be expensive and was therefore left over, knowing that it could be added later should the natural ventilation prove inadequate.

The "Cox" oven, situated in a room separate from the kitchen, was fitted with an 8 in. flue and tee in "Everite" for the products of combustion and a 3 in. vent, also in "Everite," for the steam from the ovens. Each pipe terminated outside the building in a "torpedo" cowl.

Tests on the Plant.

(a) Steam Boiler and Boiling Pans.

Before the plant was used to cook food, it was decided to hold a test on one of the steam boilers working in conjunction with the five 80-gallon boiling pans.

At the commencement of the test the steam boiler was at a pressure of 80 lb. and the water level at a noted point about half-way up the water gauge glass.

Each of the five 80-gallon pans was filled with 80 gallons of water, which came to 2 in. from the top in each case. The state of the meter and the temperature of the water in the pans were noted and the steam turned on. The condense water was collected in 5-gallon measures, and the mean temperate of each 5 gallons noted. The cold water for the steam boiler was injected from a trough supplied with a measured quantity of water at a known temperature. To conclude the test the water in the pans was brought to near boiling point and the steam shut off. The level of the water and the pressure in the steam boiler was brought back to the original and the state of the meter noted.

Below is a summary of the readings taken, and the results obtained:

Initial temperature of cold water in boiling pans	45·0° F.	
Final temperature of hot water in boiling pans	210·0° F.	
Temperature rise	165·0° F.	
Quantity of water in each pan	80	gallons
Number of pans in use	5	
Quantity of water injected into boiler	740	lb.
Temperature of water injected into boiler	52°	F.
Time of start of test	3.40	p.m.
Time for first pan to "boil"	4.22	p.m.
Time for last pan to "boil"	4.45	p.m.
Meter reading at start of test	0177380	
Meter reading at end of test	0179600	
Gas used	2,220	cu.ft.
Calorific value of gas	475	B.Th.U.
Approximate dryness fraction of steam (from previous test)	0·920	
Total heat of dry saturated steam at 94·7 lb. abs.	1,187	B.Th.U./lb.
Total heat of the above "wet" steam at 94·7 lb. abs.	1,116·1	B.Th.U./lb.
Total heat of the above "wet" steam above 52° F.	1,096·1	B.Th.U./lb.
Total heat in 740 lb. "wet" steam at 94·7 lb. abs. above 52° F. = 740 × 1,096·1 B.Th.U., which is the total heat output from the steam boiler in the form of steam	811,114	B.Th.U.
Total heat supplied to the boilers in the gas used = 2,220 cu.ft. × 475	1,054,500	B.Th.U.
Mean temperature of condense water	164°	F.
Total heat in water returned to condense tank = 740 (164–52)	82,800	B.Th.U.
Total heat used or lost on boiling pans = 811,114 − 82,800	728,314	B.Th.U.
Total heat absorbed by water in pans = 5 × 800 × (210 − 45)	660,000	B.Th.U.
Thermal efficiency of boiling pans = $\frac{660{,}000}{728{,}314} \times 100$	90·6%	

Overall thermal efficiency of the plant. Heat absorbed by water in boiling pans *plus* heat in condense water to well

$$= \frac{\text{Heat in gas used}}{660{,}000 + 82{,}000} = \frac{660{,}000 + 82{,}000}{1{,}054{,}500} = 70{\cdot}42\%$$

Thermal efficiency of steam boiler only

$$= \frac{\text{Total heat in steam evaporated}}{\text{Total heat in gas used}} = \frac{811{,}114}{1{,}054{,}500} = 76{\cdot}91\%$$

Comments.

It has been contended that a good direct heated gas-fired boiling pan was as efficient as an installation of gas-fired steam boiler and steam boiling pan. My experience has not been such. The above installation using a lagged steam boiler and insulated boiling pans gives an overall efficiency of 70·42%, whereas in a recent test a good make of direct heated boiling pan with insulated jacket gave an efficiency of 56·5%.

Food Cooking and Costs.

During the week of this test, Aug. 15 to 22, 1938, the kitchen had been in operation about eighteen months and had just been enlarged to deal with 12,000 meals daily. Each day during this week the number of children supplied was noted along with readings of both meters and the type of food cooked.

—	No. of Children.	Menus.
Monday	11,300	Stew with steamed pudding
Tuesday	11,100	Minced patty, peas, potatoes, and ginger bread and apples
Wednesday	11,100	Roast beef, carrots and potatoes, jelly
Thursday	11,100	Cottage pie, turnips, lemon and orange pudding and sauce
Friday	11,100	Fish cakes, tomatoes, rice pudding
Saturday	7,900	Minced beef stew and bananas
	63,700	

The gas consumed by the steam boilers and hot water boiler for the week was 164,000 cu.ft., and by the roasting and baking ovens 42,400 cu.ft.

The gas consumed for steam raising and water heating is

charged at our special "central heating" rate (in this case about 3·8d. per therm), while all other gas is charged at our ordinary rate (6·8d. per therm). The cost, therefore, for steam and hot water for this week is approximately £12 8s., or an average of 0·047d. per child per meal, while for roasting and baking the cost is £5 14s., or 0·022d. per child per meal. This gives a total cost of 0·069d. per child, per meal. This total is very striking when it is considered that included in this figure is also the proportional cost for the whole of the hot water used in the kitchen for general purposes and for washing food containers, &c.

The kitchen, its arrangement and cooking equipment, has received the commendation of our consumers and the admiration of various visiting municipal bodies.

Discussion.

The PRESIDENT (Mr. H. Platt, of Bolton) opened the discussion by stating that the Paper was unique in two respects—because of the matter it contained and also the manner in which it has been presented. The Paper was in such concise form that it was almost a text-book. Those who had to carry out similar installations would do well to read it and then endeavour to carry them out in a similar manner. A comparison had been made of gas-fired equipment and those of oil and electricity. Mr. Bell made a statement that labour costs were reduced to a minimum. Did he infer that running costs came out cheaper than with other types of fuel? He would also like to know if any trouble had been experienced with the steam traps collecting the grease. Reference was also made to the efficiency of the plant, and a figure of 70·42% was given as against 56·5% for straight gas heating. It must not be overlooked, however, that extra capital outlay was required for the steam boilers.

Mr. W. HODKINSON (United Kingdom Gas Corporation) said that the Paper gave an efficiency for the gas-fired steam boiler of 80%. It was usual to obtain 75%, and this figure was confirmed towards the end of the Paper when a test figure of 76·91% was given. A figure of 55% was given for an oil-fired boiler, but he was under the impression that a figure of 60/65% could be obtained. These variations would make a considerable difference in the relative costs of the two fuels. With regard to the fitting of automatic flue damper controls, he had experienced a heavy corrosion of such flue dampers and they invariably stuck in the closed position. He noted that ejectors were fitted on the boilers. Were there any stand-by ejectors? He felt they were necessary for ejecting condenser water, for when the water temperature got too high, the ejectors refused to work.

Mr. A. J. LEATHER (Blackburn) said a recommendation was made that the insides of the pans should be bower-barffed. Would Mr. Bell recommend cast-iron pans for use with "greens" alone? He would like to know if there was any special reason for using steel instead of the usual asbestos for flues. His experience agreed with a previous speaker that 80% efficiency for a steam boiler was a high figure. Did Mr. Bell take 80% as a general practice in taking out costs? He preferred 70% efficiency even if he lost the job, rather than estimate on 80% and have it thrown back at the Gas Department later. Was the question of lighting the building by gas considered?

Automatic Water Feed.

Mr. E. BATES (Manchester) observed that the benefits of automatic feed over injector feed, especially on large boilers, carried so much weight that he ventured to suggest that if these had been put forward, the consumer would have quickly realized that it would be entirely in his own interests to have this type fitted.

An electrically operated automatic feed offered the following advantages:

(1) Low power costs.
(2) Saving in steam and labour would balance the extra cost of installation in the first 12 months.
(3) An automatic feed was capable of dealing with feed water up to 212° F. providing the suction was submerged. An injector, however, was likely to give trouble should a temperature of 140° F. be exceeded. Gas consumption would, therefore, be reduced in this direction.
(4) The boiler plant would be entirely automatic and allow the attendant to take up more useful duties.
(5) A high and low water alarm could be incorporated at very little extra cost and so the risk of low water level would be reduced to a minimum.
(6) Automatic feed was steady with a consequence that the steam pressure was kept constant.

He enquired why the boiler pressure was maintained at 80 lb./sq.in. when the pressure beyond the reducing valve was only 15 lb./sq.in. The steam would, of course, be superheated to a higher degree by reducing the pressure through this range but with the vertical type of fire-tube boiler steam at lower pressures would be superheated sufficiently by coming into contact with the hot tubes in the steam space of the boiler. By working at a lower pressure a greater safety factor would be obtained, and, speaking from personal experience, a considerable saving of gas would be effected.

Advantages of Steam Cooking.

Mr. W. F. HOWELL (Manchester) said he was fully in agreement with Mr. Bell in supporting the Corporation's preference for steam cooking where possible. Not only were steam appliances more efficient, as Mr. Bell had shown, but less heat escaped into the kitchen. Further, from the consumer's point of view there was the added advantage of the price of gas for steam raising—about 4d. per therm against about 7d. per therm for general catering purposes. They had two bower-barffed gas-fired boilers in Manchester, working on a direct water system, and from their experience with these he did not think they would be suitable for domestic water after about three years' use on Manchester water. While on this point he would like to ask Mr. Bell why copper pipes were chosen for the primary flow and return when they were being used on an indirect system and connected to an iron boiler; also were flame failure cut-offs fitted to the "Ideal" boiler? While fitting an air ventilator to the flue to prevent condensate was always policy with central heating boilers, he did not think any trouble of this kind would occur with steam boilers of this size, owing to the quantity of flue gases and their rather higher temperature. They had had a lot of trouble with perforated protection plates choking up and had found it advisable to remove them and to clear any blockage in the run-off by rodding through an eye hole in the tap. On pans of 20-30 gallons they had found lifting tackle and wire buckets rather a nuisance, the kitchen staff generally preferring to lift the greens, &c., out with a wire scoop as they found it much quicker. In choosing the steam ovens, did they consider the low-pressure type? In these, water was contained in the bottom of the oven and was boiled by means of a steam coil passing through it. With this type, not only was there less danger of anyone being scalded, but the condense water was uncontaminated and might be returned to the boiler.

Mr. J. CARR (Stretford) suggested that the Paper should be forwarded to the Ministry of Health and all concerned with public buildings and general building schemes. Presumably the Paper had been written some weeks ago when the price of gas oil was 4½d. per gallon. Was that the gross cost? To-day oil could be purchased at 3d. per gallon, particularly in the North.

Diverse Figures.

Mr. H. P. LUPTON (Liverpool) submitted the following written contribution: At the time of the enquiry regarding the initial scheme for the Municipal Kitchen we had very little data regarding the steam requirements of jacketed pans and steam ovens. We made calculations and asked numerous manufacturers for the steam consumptions of their appliances. The various figures obtained were alarmingly diverse. After consideration we accepted the figures given in the Paper. The Liverpool Centre has been able to secure several steam-heated installations for its members, and the steam requirements have been estimated according to the above figures and in each case have proved satisfactory. For steam raising and central heating many undertakings have a special rate. This is the case in Liverpool. For certain cooked food processes there has been a tendency to move from water-jacketed to steam-jacketed pans. A year and a half ago we learned that a large gas consumer was proposing to discard his gas-heated water-jacketed pans and install a coke-fired steam boiler. It was immediately suggested that for a cooked meat factory a solid fuel boiler was not ideal on account of the dust and ashes which necessarily would be present. A gas-fired boiler was ultimately installed and the gas consumption saved. The output from the new plant is double that originally obtained without any increase in gas consumption. Several works in Liverpool are taking steam from gas-fired boiler plant for canteen and hot water purposes.

With regard to the use of gas in the baking and confectionery trades, there is no doubt that the gas-fired ovens now on the market are the finest in the country. On these ovens, of both the static and travelling types, the heat distribution is very uniform, control is simple, and maintenance negligible. The single shop confectioner is frequently prepared to pay the ordinary industrial rate for gas, and ovens of the Portway type are an economic proposition at 7d. per therm. For the large scale baker oil has been favoured for some time past, but gas is now gaining considerable ground and several large installations of gas-fired ovens have recently been put down. You will find that the claim is frequently made that for gas to compete with oil it must be sold at 3d. per therm. This claim can only be justified on theoretical grounds, for where gas has replaced an oil-fired plant it has been found that gas at 4·25d. per therm is more economical than oil at 77s. 6d. per ton. Very considerable savings have recently been made in Liverpool where gas at 4·65d. per therm replaced oil at 77s. 6d. per ton.

The Author's Reply.

Mr. BELL, replying to the discussion, said it was clear that the main point of his Paper had been appreciated—viz., that although a description had been given of the kitchen apparatus necessary to feed 10,000 children a day, yet the data were applicable to every large catering installation.

The particular point of labour costs in the installation meant that when it was decided not to include automatic feed pumps at least part of the time of the man on duty was spent on the boilers, whereas on electrical or oil installation ejectors this was not the case, though they might, or might not, be fitted with the alternative of automatic steam pumps. Grease traps did require very regular attention or they would not function. In that particular kitchen the male attendant cleaned the traps twice weekly.

An efficiency of 80% had been taken for the calculation, as against 55% for oil, whereas in the test the figure came out at 76%. There was a discrepancy of 4% between theoretical and test efficiency, and he agreed that 76% ought to have been taken in the calculation. The test efficiency had been maintained. On a number of occasions the efficiency of oil-fired boilers had ranged from 65/75%, but 55% for oil against a gas efficiency of 76% was more the correct figure, unless there was very careful maintenance. A greater amount of maintenance was required as compared with the regular monthly cleaning of tubes on gas-fired boilers. In Liverpool, no trouble had been experienced with the sticking of automatic dampers. When the water got into the region of 160°, trouble had been experienced with the introduction of water from lower levels—particularly during the last 20 minutes the steam boilers were in use the ejectors began to fail. A supply had then to be taken from the roof. This was the only alteration that had to be made.

If the bower-barffing was not satisfactory, corrosion could be avoided by alternating between greens and greasy foods. The steel flue was partly adopted merely because the connexion was a peculiar shape and had to be in welded sections.

Mr. Bell appreciated the points made regarding the use of a pump instead of an injector, but he would have put in a steam and not an electric pump. With regard to the high and low water alarm, an alternative had been fitted to meet the requirements of the Factories Act. It was a low-pressure cut-off on the boiler. The 5-lb. steam pressure gave a speed in cooking which was a great advantage. Low-pressure steam was not so fast. Flame failure cut-out had not been fitted, but an independent by-pass. Mr. Bell said that so far as he was aware, the information contained in the Paper had not been forwarded to the Ministry of Health, but he thought suitable extracts would be made for circulation to the Industrial Centres Committee. The figure given for oil was the ruling price at the time of writing the Paper. The figure of 4½d. included 1d. tax.

Vote of Thanks.

A vote of thanks was proposed by Mr. J. GRAHAM (Lancaster). The wealth of information Mr. Bell had given to them was appreciated by every member. Great credit was due to the Liverpool Gas Undertaking in obtaining the load for gas.

Mr. F. CARTLEDGE (Oldham) seconded and said that they had been provided with data which were unobtainable in most works. It was a valuable contribution and one to which reference would be made when there was work to be done on the catering side.

The Tale of the Rates

Interesting Analysis of Municipal Rating

We are once again indebted to the Preston Borough Treasurer (Mr. W. Allison Davies) for his Annual Statement—the 54th of the series—which sets out the various rates levied in 353 municipal areas, together with interesting details regarding the appropriation of the rates in respect of the different municipal services, totals of populations, rateable values per head of population, and particulars relating to gas, water, and electricity supplies.

This "tale of the rates" makes an interesting study, disclosing as it does the general trend of municipal affairs throughout the country. While the figures of rates levied in the pound must not be taken as necessarily indicative of the actual burden imposed upon the ratepayer in comparison with the corresponding figure for another town, they do, nevertheless, when set against the previous year's figure demonstrate the general tendency in the area concerned. Where the figure in the pound may be high, the rateable value may be low, and *vice versa.*

As we have suggested, the real significance of the statistics can only be fully appreciated by comparing them with the corresponding figures for the previous year. This reveals that of the 353 authorities covered by the return no fewer than 80% have increased their rates, while but five can show improvement. Indeed, so outstanding by contrast are these five oases of light amidst the surrounding gloom that they are, perhaps, worthy of mention by name—Aldershot, Barnsley, Bexhill, Paynton, and Wakefield.

Of the 28 Metropolitan Boroughs included in the return every one has increased its rates by amounts varying from 4d. in Chelsea and Holborn to 1s. 6d. at Greenwich. Poplar and Westminster still retain highest and lowest places with 18s. and 10s. 3d. respectively.

In the 84 County Boroughs dealt with, the average rate has been increased from 13s. 5½d. to 13s. 11½d., fifty-nine authorities assisting towards this result. Bournemouth has the lowest figure at 7s. 10d. in the pound and Merthyr Tydfil the highest at 27s. 6d. —the latter being an increase of 1s. over the previous year. In the 157 Boroughs, the average has risen from 12s. 3½d. to 12s. 10½d., as many as 127 showing increases. In this category Hove shows the lowest figure at 7s. 10d. and Jarrow the highest at 22s.—an increase of 3s. Of the 84 Urban Districts, 68 show increases, resulting in the average rising from 13s. 11½d. to 14s. 7d. Here Walton and Weybridge are at one end of the list at 8s. 11d., while Rhondda has the highest figure at 25s. 6d. The depressed areas unfortunately continue to show exceptionally high figures.

Among the particulars of domestic services, the return gives the prices of gas per therm and per 1,000 cu.ft. within and without the districts concerned, together with the declared C.V. of the gas supplied. Other details of interest are the estimated transfers from municipal undertakings to the relief of the rates and, conversely, the estimated transfers to undertakings in respect of deficiencies. It is satisfactory to find but three of the latter so far as gas undertakings are concerned, and these make a total charge upon the rates of some £4,230. On the other hand, 19 municipal gas undertakings contribute an aggregate sum of not far short of £120,000 (estimated) towards the relief of the rates —the Nottingham Gas Department still being the most generous in this respect with its usual estimated quota of £31,500. In this connexion, it should be pointed out, however, that the return is not intended to demonstrate the desirability or otherwise of municipal trading or the use of the profits therefrom for relieving the rates. Indeed, the large majority of municipal gas undertakings are free to direct their profits to meeting competition by improving their service and lowering their charges.

Board of Trade Announcement

On Jan. 1, 1939, certain provisions of the Gas Undertakings Act, 1934, come into force. These provisions impose obligations on statutory and non-statutory gas undertakers and confer powers on local authorities. In connexion therewith, the Board of Trade, in pursuance of their powers under that Act, have made the following prescriptions:

1. The Board of Trade Gas (Non-Statutory Undertakers and Non-Thermal Unit Undertakers) General Prescription, 1938 (S.R. & O. 1938 No. 1,474), dated Dec. 2, 1938, prescribing the places at which, and the apparatus and method by which, tests are to be made to ascertain whether any non-statutory undertakers or undertakers who are not thermal unit undertakers are supplying gas in conformity with section 10 of the Gas Undertakings Act, 1934; the method by which any such apparatus is to be verified and the time and form of the report to be made by the gas examiner to the Board of Trade and the local authority, Quarter Sessions, or Sheriff by which he was appointed and to the undertakers to whom the reports relate, and the means by which the results of the tests shall be made available to the public. This Prescription which comes into force on Jan. 1, 1939, may be obtained, either directly or through any bookseller, from H.M. Stationery Office, price 3d.

Attention is directed to sub-section (3) of section 5 of the Gas Regulation Act, 1920, as that section will read after Jan. 1, 1939:

> "(3) All undertakers and non-statutory undertakers shall provide and maintain to the satisfaction of the Board of Trade the testing places prescribed in their case and shall give any gas examiner access to any such testing place for the proper execution of his duty."

2. The Board of Trade Gas (Thermal Unit Undertakers) General Prescription, 1938 (S.R. & O. 1938 No. 1,472), dated Dec. 2, 1938, which continues in force, after Jan. 1, 1939, the General Notification of the Gas Referees, re-issued on Aug. 31, 1934, and the Special Prescriptions issued from time to time by the Gas Referees so far as they continue to be applicable.

The Gas Companies' Protection Association

The Forty-First Annual General Meeting of the Gas Companies' Protection Association was held at Caxton Hall, Westminster, S.W. 1, on Thursday, Dec. 8—the Chairman of the Committee (Mr. F. G. BREWER, of the South Metropolitan Gas Company), presiding.

The SECRETARY (Mr. R. Girdlestone Cooper) read the notice convening the meeting, together with the minutes of the last annual general meeting, which were confirmed and signed.

The CHAIRMAN, moving the adoption of the Committee's Report and Accounts for the year ended Sept. 30, 1938, said:

Your Committee's Report begins by recording the great loss which the Association, and the whole Industry, have suffered during the year under review by the deaths of four men whose names stand high in its annals. I believe that you will readily allow me to add a few words to that record.

If we tried to epitomize their careers in one phrase I do not think that we could do better than to say of them that "service before self" was the keynote of their being. Dr. Carpenter, Mr. R. W. Edwards, Sir John Ferguson Bell, Mr. G. W. Anderson—they were men whose intellectual and administrative qualities would have gained them success in almost any walk of life; but success, if that word is limited to its more worldly meaning, was what seemed to matter least to them. Dr. Carpenter's scientific attainments and his contributions to the development of the Industry to which he devoted his life have been recorded elsewhere by those qualified to speak of them, and it is not for me to attempt to add to those tributes. But I may perhaps be permitted to express something of the gratitude with which the Association remembers his long and close interest in all its activities and of the debt which it owes to his wise guidance. Fearless for what he believed to be right, he never shrank from a fight when he thought that course justified, and cross-examining counsel found in him a witness who had the spirit as well as the knowledge to turn aside the sharpest barbs of their interrogations. With the basic price system Dr. Carpenter's name will always be associated, but perhaps still more he would wish to be remembered for his furtherance of Co-partnership to which, as the successor of Sir George Livesey, he gave himself heart and soul.

The Association was fortunate in finding as Dr. Carpenter's successor in the Chairmanship Mr. R. W. Edwards, who presided over these meetings from 1928 until illness compelled his absence last year. Many of us had known that for some time his health had been far from good, but we had hoped that a period of rest would have brought recovery and that he would have been able to resume the work for the Association which he so greatly enjoyed and which he so ably discharged. Unhappily our hope was not fulfilled, and soon after last year's meeting he passed away. Courteous and patient, jealous of the prestige of the Association, and mindful particularly of the needs of its smaller members, he and his great experience will be sadly missed in the guidance of its affairs.

Sir John Ferguson Bell's death occurred just before last year's meeting and, in Mr. Edwards's absence, I then referred briefly to it. Suffice it now if I say of him, as of Mr. G. W. Anderson, that the Industry has been made the richer by their genial and sagacious presence.

The English public utility services have had a happy power of attracting to themselves men of the mould of those whom I have just mentioned: and it would be a sad day if ever that power were allowed to weaken. For "service" is indeed the right word for them, and probably at no time have the opportunities and the responsibilities of service been greater than they are now. If much of the last war must be counted sheer loss, at least one good thing was quickened by it—a sense of social responsibilities which is not content to leave conditions of life as they were. Better housing, nutrition, physical fitness, hygiene—all are objects for which that spirit is at work, and all are objects in the attainment of which the Gas Industry can be of great help. In the last twenty years at least £750,000,000 has been spent from public funds in providing better houses. Strange as it may seem, the Gas Industry has at some times and in some places had to fight for the right of helping to turn those houses into homes. Happily those days seem to be passing, and local authorities are now the more ready to welcome co-operation with gas undertakings. In fact, it may be said that at no time has the prestige of gas stood higher than it stands to-day, and that more and more with those who appreciate an efficient and reliable fuel service it is becoming an integral part of domestic equipment.

In creating a clearer atmosphere the Gas Industry again can play a leading part. A short time ago the Leader of the London County Council, Mr. Herbert Morrison, mentioned that every year 240 tons of soot fell on each square mile of London and that the cost in money alone—apart from the more tragic loss of health—was estimated to be £4,000,000, or the equivalent of a 1s. 4d. rate in the Metropolis. When it is remembered that the rates collected in England and Wales during 1937-38 amounted to £176,000,000, or an average poundage of 11s. 7d., we can envisage what savings there would be if smokeless cities became, as they can be made to become, a reality, and what further benefits there would be in improved health and efficiency. The price at which gas can be supplied is, as we all recognize, an important consideration, and it is significant that in many parts of the country undertakings are now paying increasing attention to the institution of systems of charge which will help to place within the means of those for whom they are intended the benefits of a complete labour-free and smokeless fuel service.

May I now turn in more detail to the year under review? Compared with the more strenuous legislative excitements of other periods, the twelve months ended last September have been a comparatively peaceful time for the Industry; but over all has hung the shadow which was dissipated, or at least receded, on that eventful night at Munich. It is hardly a happy commentary on modern civilization that air raid precautions should come to be regarded as an essential part of national life; but apparently that must be accepted as the fact, at least for the present. The Government have made it clear that they place great importance on the continuity of the supplies afforded by the public utility services, and undertakings have been encouraged to submit the schemes by which they propose to endeavour to secure that end. But to carry out such schemes costs money, and a good deal of it; and while the utilities must naturally make themselves financially responsible for the protection of their personnel and the vital parts of their property, they not unnaturally ask that other work undertaken as part of national defence should be recognized, at least to the major extent, as a national charge. It may be said that the Government have in principle recognized the validity of their contention; but the degree of their recognition has yet to be determined.

The Report now before you gives a record of the Association's multifarious activities, and if, as I have said, the year has been free from major legislative excitements, the record is, I hope you will agree, one of useful work for the members. First as to the Accounts, you will find an entry of the sale of £350 of 3½% War Stock, which was required to liquidate the balance of the Association's costs in connexion with the Joint Select Committee on Gas Prices. Last year, as you will remember, £350 was also sold towards meeting a deficit of £634 resulting from the same cause. This year we have disposed of that deficit and have also met the balance of our Parliamentary Agents' taxed costs. A surplus is always better than a deficit, from whatever cause it arises; but we may, I think, be satisfied that the deficit remaining at September, 1938, is no more than £44 15s. 3d. You will have noticed that when the revenue account was prepared outstanding subscriptions were £19 19s. I am glad to say that this sum has now been reduced to only £4 4s. Whether for this satisfactory result we are indebted to the importunity of the Secretary or to the conscience of the members, I must leave them to settle; but you will, I hope, agree that the accounts show commendable evidence of economy in administration and that the members have received full value for their subscriptions. Our reserves still stand at a comforting and substantial figure.

Income-Tax.

The vexed questions of allowances for depreciation and for the wear and tear of buildings containing power-driven machinery have continued to engage the attention of your Income-Tax Sub-Committee, and only a few days ago a deputation consisting of members of that Committee and of the Income-Tax Committee of the National Gas Council attended at Somerset House for a discussion with officials of the Board of Inland Revenue. In particular with regard to depreciation, the new types of appliances now supplied in response to popular tastes call, in our submission, for a review of the allowances under the agreed scheme, and it is hoped that a satisfactory settlement may soon be reached.

Coal.

In common with other purchasers of coal, the Gas Industry is not happy about the latest Coal Act and the selling schemes which it continues and confirms. Thanks to the labours of the Conjoint Conference of Public Utility Associations, some con-

cessions were obtained during the passage of the Bill through Parliament, and in particular there were the four assurances given by the colliery owners which, although not embodied in the Bill, were recorded in a White Paper. They are that consumers shall be at liberty to change their source of supply for reasons other than price; that in all districts the Executive Boards will be prepared to meet representative bodies of consumers to discuss general questions arising out of the selling schemes; that a purchaser will be enabled to refer to a Committee of Investigation a complaint in respect of any price quoted to him; and that coal, the quotation for which is the subject of investigation, will be reserved for the purchaser pending the hearing of a complaint by a Committee of Investigation.

It is recognized that these assurances, though we would have preferred them to be part of the Act, meet some of the points of criticism; but the fundamental weakness of the selling schemes and of the virtual monopoly of price-fixing which they established remains. The Gas Industry is no less anxious than others that the capital and labour employed in the mines should be adequately rewarded, but it cannot be otherwise than apprehensive about the despotic powers now granted to the suppliers of its raw material. It is to be hoped that the coal industry will realize that the goodwill of a customer buying some 19,000,000 tons a year is a not inconsiderable asset; in the meantime gas undertakings cannot afford to relax their vigilance when any occasion for making use of the existing machinery for the representation of complaints arises.

Another matter on which the Conjoint Conference has been engaged is the cost of protecting or re-laying mains and cables where that work is necessitated by the reconstruction of a highway. Parliament has been ready to grant such protection when it has been asked for in individual Bills, and there is no lack of precedents for it; in particular I may mention the West Yorkshire Gas Grid Act. It is indeed time that the principle was recognized once for all in general legislation. A fortnight ago the Minister of Transport, in a reply in the House, announced his intention to move the appointment of a Joint Select Committee to examine the state of the laws relating to highways, and all concerned will await with interest the proceedings before that Committee and its findings.

The Hire Purchase Act will come into operation on the 1st of next month, and members are advised to see that the form of agreement used after that date complies with the Act. The Conjoint Conference, although unable to obtain the exemption of public utilities from the Act, were successful in securing a provision to the effect that, in the event of a breach of an agreement, the costs of installation are recoverable separately and *in toto*, provided that they are stated in the agreement as a definite and separate sum.

With regard to Rating, the attention of members is particularly directed to the advice in the Report that they should be careful to safeguard their position if asked to supply information for provisional revised lists, remembering that the period before the next valuation has been extended.

The Report records other activities of the Conjoint Conference during the year, and I will not refer again to them, except to say that the Conference continues to discharge its functions in a manner and with an authority for which public utility undertakings, whether gas, water, or electricity, have true cause to be grateful.

The British Gas Federation, of which your Association is one of the five constituent members, has continued to provide the Industry, not only with the means of common council, but also with an authoritative façade for the display of the Industry's activities. At Birmingham, Olympia, and elsewhere there has been a number of notable exhibits, and particular mention should be made of the part played by the appliance manufacturers in the success of these occasions. Especially gratifying is the response to the Federation's appeal for funds to provide a permanent Gas Exhibit in the Science Museum at South Kensington; it is understood that promises of no less than £19,000 have been received towards the amount required.

While mentioning the Federation I should like to refer to another matter affecting the national organizations of the Industry. As you probably know, proposals have been made during the year for the reconstitution of at least some of those bodies with the object of moulding them into a more comprehensive unity. Your Committee feel that it is their duty sympathetically to consider any proposals placed before them which may tend to greater simplification and to the avoidance of overlapping and duplication of effort, but, so far as the Association is concerned, any proposals must, of course, have adequate regard to the needs and interests of companies. At present the proposals have not gone much beyond the stage of preliminary consideration. Any scheme affecting the constitution or the future of the Association would, as indeed it must, be placed before the members for their decision.

Once again it is my pleasant duty to pay tribute to the valuable work done by the Secretary and his staff. The Report mentions some of the subjects on which his advice and help have been sought, but the paragraph is only a selection and by itself gives a very incomplete picture of the variety of matters on which the Secretary—who for this purpose is the Association—has been consulted. I know that my colleagues on the Committee will join heartily with me in this tribute, and with the moving of the adoption of the Report and Accounts, I associate also a vote of thanks to Mr. Cooper and to those who work under him.

I cannot end these remarks without a few words of personal gratitude to my colleagues on the Committee for all the help which they have given me since Mr. Edwards' death. We Londoners are fortunate, but for many of my colleagues attendance at meetings has meant very long journeys. I sincerely believe that they have not begrudged the time given by them to what I may call our family Association.

I now formally move that the Committee's Report and the Accounts for the year ended Sept. 30, 1938, be received and adopted, and that the Report be entered in the minutes.

Mr. C. F. BOTLEY (Hastings), seconding the resolution, said they were all indebted to the Chairman for his clear exposition of the principal problems with which they were faced to-day, and he sincerely commended his observations to a much wider audience than those present on that occasion. One point he liked particularly was where the Chairman referred to them as a "family association." Not only did the Association attract to it men of character, but it collected together a great many good fellows; he therefore especially welcomed this term. With reference to coal, the industry was handicapped at the present time in their desire to render good service by the high prices they had to pay, and the sooner they could see some reduction the more able would they be to extend their useful activities to a much wider sphere.

The resolution was carried unanimously.

The New President.

The CHAIRMAN said that the Committee had unanimously resolved that Mr. Frank H. Jones be asked if he was willing to allow himself to be nominated for the Presidency of the Association in succession to the late Dr. Charles Carpenter. Mr. Jones had agreed, and it gave Mr. Brewer great pleasure to propose Mr. Jones' election.

Mr. RALPH HALKETT (Sheffield), seconding, said they all knew the high position Mr. Jones held in the Industry; they could have no better man to serve them as President. The resolution was unanimously adopted.

On the proposition of the CHAIRMAN, seconded by Mr. BOTLEY (Vice-Chairman), the following gentlemen were re-elected Vice-Presidents:

Mr. R. Bruce Anderson.
Mr. F. J. Bradfield.
Sir Reginald Clarry, M.P.
Mr. A. A. Johnston.

It was proposed by Mr. W. PHILLIPS (Luton), seconded by Mr. E. J. K. FUSSELL (Tottenham), and unanimously agreed that the following members of the Committee retiring under Rule 12 be re-elected—namely,

Mr. F. G. Brewer.
Mr. C. F. Botley.
Mr. W. E. Caton.
Mr. B. A. Mallender.
Mr. J. Wesley Whimster.

On the proposition of Mr. PHILLIPS, seconded by Mr. BOTLEY, the further vacancy on the Committee was filled by the election of Mr. E. H. Harman (Commercial Gas Company).

The Association's Hon. Auditor (Mr. Hyde C. Burton, F.C.A.) was also re-appointed, a cordial expression of thanks being passed to him for his services.

Mr. FUSSELL thereafter moved a hearty vote of thanks to the Chairman for presiding over the meeting. It was only a year ago that Mr. Brewer had stepped into Mr. Edwards' shoes, and they wondered at the time whether they could get anyone equal to him. Everyone there that day would like to be associated with the Chairman's remarks about Mr. Edwards. They deplored his loss and that of the other members; but they were very fortunate in having Mr. Brewer as their Chairman, and they would all like to congratulate him on his excellent and concise Address to them. That was only a reflection of the way he conducted all his duties on the Committee. They looked to him for guidance, and when he called attention to the money they had spent in connexion with the Gas Prices Enquiry it would be appreciated that the money was well spent. They also congratulated him on the manner in which he gave evidence at that Enquiry; it was frank and helpful to the Industry.

The vote of thanks was carried unanimously, and, in acknowledgment, Mr. BREWER spoke of Mr. Edwards' long experience and great knowledge of the Industry, and hoped that he himself would go on learning more about the Industry as time went on; he could only do so as long as he continued to receive the help and advice of the members. He concluded with an expression of thanks to the Secretary for his valuable services.

This Portable Prepayment Gas Heating Unit for Hotel Bedrooms

is now being Advertised to Hotel - keepers through their Technical press —be ready for their enquiries.

A few of these GASCLOCK units will cover the heating requirements of many bedrooms.

THE GASCLOCK INSTALLATION IS THE NEATEST AND MOST COMPACT PORTABLE PREPAYMENT GAS-HEATING UNIT YET DEVISED.

The complete Unit combines the 5-radiant Newscreen Gas-Fire with loose front panel, a Time-Clock, a "Plug-in" Connector and a length of rubber-covered steel Flexible Tubing.

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TRADE NEWS

What the manufacturers are doing by way of new and improved appliances, plant, and processes.

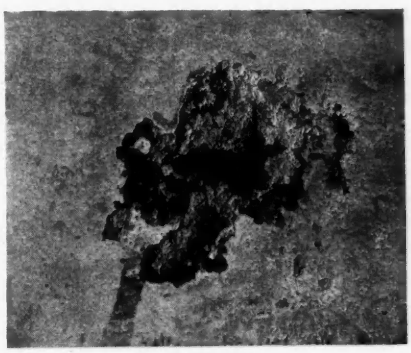
Industrial Heating Equipment.

Three new catalogue sheets relating to industrial heating equipment have been issued by the Selas Gas and Engineering Company, Ltd., City Road, Manchester, 15. These deal with the GLC gas-fired laboratory crucible furnace, the "Selas" gas-fired low-temperature salt-bath furnaces, and the GLC laboratory sand bath.

A.R.P. Tests on "Kimoloboard."

At a demonstration of fire protection and decontamination methods organized by Mr. Albert Kennedy and Vice-Admiral A. H. Norman, who are in charge of A.R.P. in the Royal Borough of Kensington, some remarkable experiments were carried out showing the complete resistance of "Kimoloboard" to the intense heat generated by thermite and electron bombs. The purpose of the demonstration was to show how "Kimoloboard" definitely stops thermite and electron, so that as a lining to the attic floors and rafters in a house, or for the erection of fireproof partitions in factories, it is claimed to confine fires caused by incendiary bombs to their source, thus making easier the work of the firemen and A.R.P. helpers by preventing the spread of fire, and saving buildings from destruction.

In the first test a sheet of "Kimoloboard" ½ in. thick was placed upon a wooden trestle and upon the sheet was placed a 1 kilo thermite bomb. This was ignited and not only did the "Kimoloboard" stand up to this drastic treatment, but as soon as the reaction had subsided it was demonstrated that the back of the board could be touched with the hand without discomfort, and the paper label which had been attached to the back was



How "Kimoloboard" resists thermite, resulting in only slight surface impingement and deposits of matter.

actually unscorched. "Kimoloboard," a product of Cellactite and British Uralite, Ltd., is composed of asbestos fibre and diatomaceous earth. Both these materials are, of course, well known fire resistants, and their combination in "Kimoloboard" by a patented British process has resulted in what is stated to be a really fireproof panelling board. This has been proved to withstand even the oxy-acetylene flame of 6,000° F., and in an L.C.C. Fire Brigade test it has been shown that even when subjected to this intense heat "Kimoloboard" may be sprayed with cold water without cracking.

After the first successful test with the thermite bomb, a further sheet was placed upon the trestle, and this time four bricks were placed upon the surface forming a hollow square into which the incendiary mixture was placed. This arrangement intensifies and concentrates the heat, retaining the molten products of the reaction in contact with the "Kimoloboard." The thermite in this case had an addition of electron metal which prolonged the burning, and, in spite of the violent intensity of the heat produced, it was again shown that the "Kimoloboard" had suffered only slight surface impingement and the back of the sheet, as before, could be touched, and the label was intact.

Ensuring Gas-Tight Mains.

The "Felton" patent joint tester is claimed to be the only positive method of testing Stanton-Wilson and similar joints. It is also stated to be equally effective on any type of joint. The tester will reveal the smallest leak, and thus obviate the subsequent opening of road surfaces with heavy reinstatement and other costs. It is extremely useful in reducing the unaccounted-for gas figure. It is a simple device, comprising a flexible wrapping adapted substantially to surround the joint and form a pocket to hold water or other suitable liquid for effecting the test. The tester has been thoroughly proved in practice on extensive mainlaying, one length extending eleven miles, undertaken by the Newport (Mon.) Gas Company, who are willing to hire it to any undertakings who desire to use it.

Office Systems Exhibition.

An exhibition of modern office systems was held at Charing Cross Hotel from Nov. 28 to Dec. 2. This was a combined effort by the Remington Accounting Machine Division, Remington Typewriter Division, Library Bureau, Ltd., and Smith Premier Typewriter Company, Ltd. A large number of business executives and professional accountants attended during the week and showed a keen interest in the various demonstrations and exhibits. Accounting and adding machines were shown on such work as multiple-copy invoicing with automatic feed of forms and carbons; sales ledger and statement posting; preparation of wages sheets; simultaneous typing of cheques and cash book, the latter being automatically added at the same time. It is easy to visualize from such machines how the work of many an office could be simplified and reduced, to the benefit of everyone concerned.

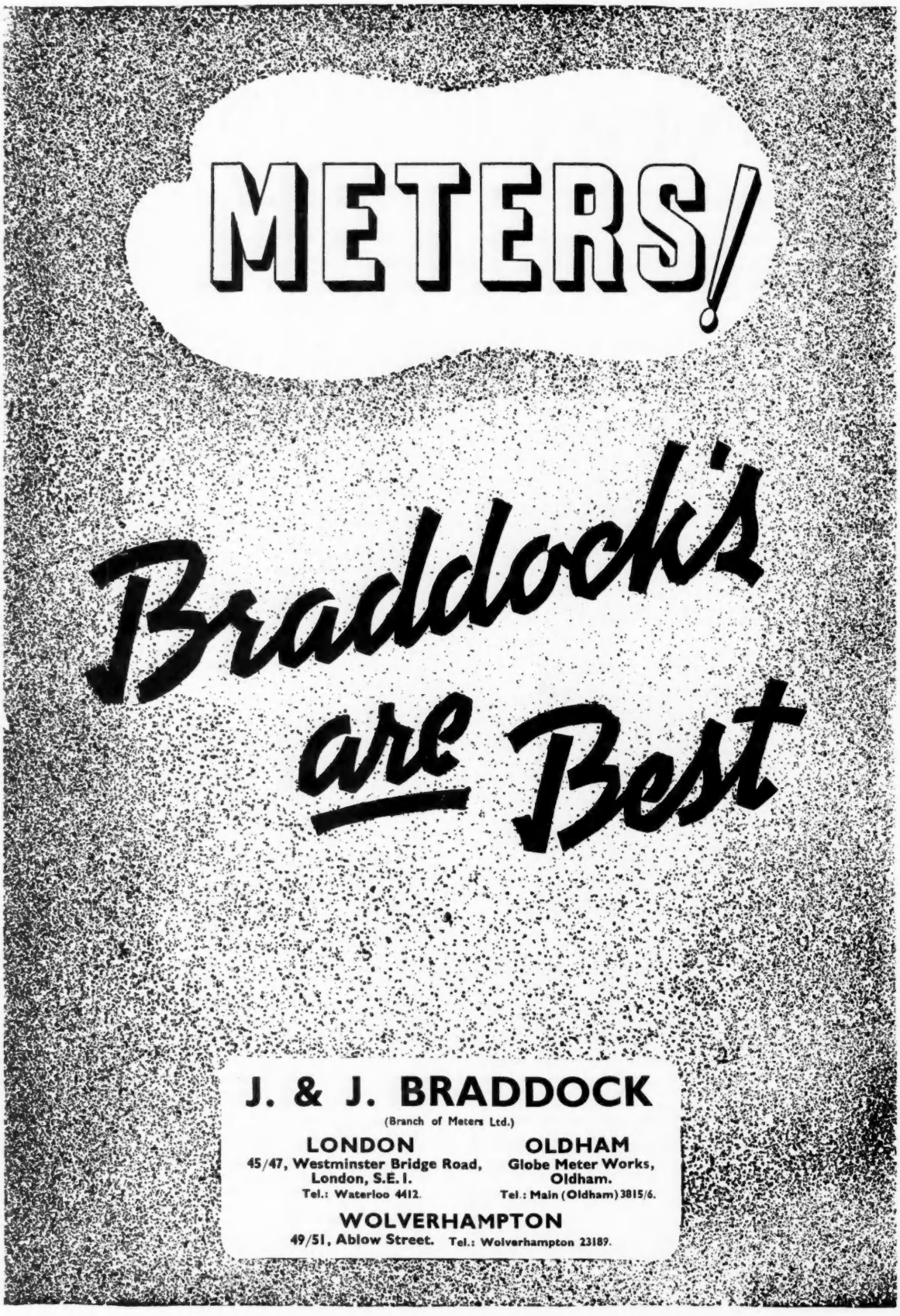
The Harrison Purging Machine.

The hard-earned reputation of the Industry for unfailing service has only been acquired by ceaseless vigilance in the exercise of all precautions against every possible source of danger; any invention promoting additional safety is very quickly adopted. All engineers will appreciate the potential source of danger created when plant such as gasholders, purifiers, or mains are purged with air or, alternatively, when, for example, the air present in a gasholder after repair is expelled by the incoming gas. The Harrison patent purging machine, to which extensive reference has been made in these columns, has been specifically designed to produce the necessary inert gas of constant composition to eliminate this danger.

In a recently published attractive folder with an arresting cover in colour, Messrs. W. C. Holmes & Co., Ltd., Huddersfield, draw attention to the many advantages, including the above, of the Harrison purging machine, and to "other things we make," to which the Industry needs but little introduction. Among the illustrations is a 35,000 cu.ft. per hour gas-fired machine, supplied to the Gas Light and Coke Company, and a portable self-contained unit, which can be hired to works requiring occasional use of a purging machine.

Year's Working at Hereford

The annual statement of accounts of the Hereford Gas Undertaking shows that the year's working resulted in a gross profit of £9,729, compared with £11,208 for 1937, a decrease of £1,479; after deducting the sums required for interest and sinking fund, there remained a net profit of £832, as compared with £2,452. The net revenue had been increased to £15,412. Among the items of increased expenditure to be taken into consideration the biggest factor—as Mr. A. R. W. Roberts (Engineer and General Manager) points out in his report—was the advance of 1s. per ton in the delivered price of coal, which cost £21,895 of the total expenditure of £47,602. The income from gas showed a reduction as compared with 1936-1937, but all classes of domestic consumers enjoyed a reduction in price as from Oct. 1, 1937, which was represented by a sum of approximately £1,000 for the six months. With regard to the capital account much expenditure had been incurred in providing new mains and services for Council and other building estates. The clearance of slums introduced a heavy charge on the department, but in future years the revenue account should benefit by the anticipated increase in gas consumption.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49/51, Ablow Street. Tel.: Wolverhampton 23189.

Markets and Manufactures

Current Sales of Gas Products

The London Market

Dec. 12.

Tar prices in general remain unchanged, to-day's values being as follows:

Pitch, nominal at about 30s. per ton f.o.b.
Creosote, about 3¾d. to 4d.
Refined tar, 3¾d.
Pure toluole, about 2s. 3d.
Pure benzole, about 1s. 9d.
95/160 solvent naphtha, 1s. 7d. to 1s. 8d.
90/160 pyridine, 10s.
All per gallon naked at makers' works.

The Provinces

Dec. 12.

Crude Gas-Works Tar, 14s. to 19s.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 29s. to 30s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 29s. to 30s.* Toluole, naked, North, 1s. 7½d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 7¾d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 1s. 2½d. to 1s. 3d. Creosote, *ex* works, in bulk, North, liquid and salty, 4⅛d. to 4⅜d.; low gravity, 4¼d. to 4½d. Carbolic acid, 60's, 1s. 7d. to 1s. 10d. Naphthalene, £13 10s. to £16. Salts, 70s. to 75s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality unsaleable. Heavy oil; Unfiltered anthracene oil, min. gr. 1,080, 4¾d. to 4⅞d.; filtered anthracene oil, min. gr. 1,080, 5¼d. to 5¾d.; heavy tar oil, gr. less than 1,080, 4¼d. to 4⅜d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Scotland

GLASGOW, *Dec.* 10.

Market is still suffering from a lack of business and prices of most products are easy.

Crude gas-works tar.—Actual value is about 35s. to 36s. per ton *ex* works in bulk.

Pitch is offered freely at 22s. 6d. to 23s. 6d. per ton f.o.b. for export and 20s. to 22s. per ton in bulk for home trade.

Refined tar.—In the home market price is maintained at 3¾d. to 4d. per gallon, while for export competition is keen at about 2¾d. to 3d. per gallon, both into buyers' packages at makers' works.

Creosote oil.—There is very little activity with makers' quotations as under: Specification oil, 4d. to 4¼d. per gallon; low gravity, 4¼d. to 5d. per gallon; neutral oil, 4d. to 4¼d. per gallon; all *ex* works in bulk.

Cresylic acid.—Orders are still difficult to secure and prices are easy as follows: Pale, 97/99%, 1s. 2d. to 1s. 4d. per gallon; dark, 97/99%, 1s. to 1s. 2d. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 8d. per gallon; all according to quality *ex* works in buyers' packages.

Crude naphtha.—Available supplies continue to command 5½d. to 6d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha. — 90/160 grade is 1s. 3½d. to 1s. 4d. per gallon, and 90/190 heavy naphtha is round 1s. 1d. to 1s. 1½d. per gallon.

Motor benzole is 1s. 3d. to 1s. 4d. per gallon.

Pyridine.—90/160 grade is 8s. to 9s. per gallon and 90/140 grade is 9s. to 10s. per gallon.

Benzole Prices

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole..	0	9½	to	0	10	per gall. at works
Motor ,, ..	1	3	,,	1	3½	,, ,, ,,
90% ,, ..	1	4	,,	1	4½	,, ,, ,,
Pure ,, ..	1	8	,,	1	8½	,,

Contracts Advertised To-Day

Compressor and Generator.

Keighley Gas Department. [p. 866.]

Chapel, Whaley, and District Gas Company

Chapel, Whaley, and District Gas Company recommend a final dividend of 2% for the year, making 4% for the whole year. The Directors point out that the retort chambers have been in operation for ten years and it has been necessary to rebuild two of them at a cost of £1,520. This has resulted in a very much heavier charge under the heading of repairs to works and a corresponding reduction in profits.

Sanction Has Been Received by the Darlington Town Council from the Ministry of Health to borrow £1,500 for gas lighting in Woodland Road, Darlington.

♣ ♣ ♣

To Replace the Inadequate Accommodation at Eastbank Street, the Southport Gas Committee has appointed a sub-committee to consider and report on the question of a new site for offices and workshops for the distribution department.

PROTECT WITH

METROTECT

a bituminous paint producing a pleasant satin black finish with highly waterproof and anti-corrosive properties.

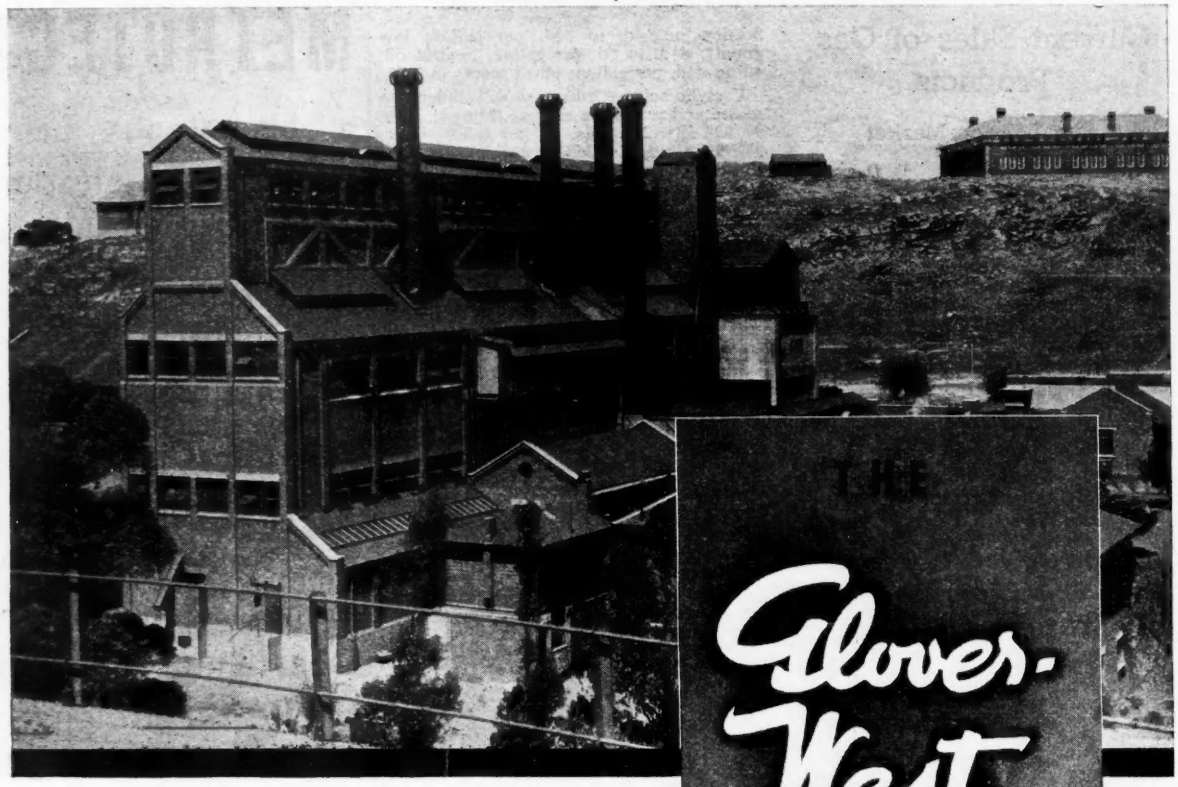
Protects steel-work which is continuously or periodically immersed in water. Does not become brittle on prolonged atmospheric exposure. METROTECT flows freely under the brush and can be applied quickly and without effort even in cold weather.

Prices and further particulars from—

SOUTH METROPOLITAN GAS CO.

PRODUCTS DEPARTMENT,
REGIS HOUSE,
KING WILLIAM STREET,
E.C.4.

● CARBONIZATION IN VERTICAL RETORTS



The modern Glover-West vertical retort plant has behind it the accumulated experience of 64 years' constant research and development for the advancement of gas production methods the world over.

● *430 plants have been built or are on order for 230 Gas Undertakings in 24 countries.*

●

The picture shows the three installations of Glover-West vertical retorts at Johannesburg City Council's Cottesloe gasworks. The carbonising unit of the complete modern gasworks ordered for Johannesburg from this company in 1926 has been trebled to meet the rapid growth of demand. The latest extension put to work in 1937 is nearest the camera.

●

WEST'S GAS IMPROVEMENT CO. LTD.,

MANCHESTER: Albion Ironworks, Miles Platting ■ LONDON: Columbia House, Aldwych, W.C.2

GAS STOCKS AND SHARES

Business on the Stock Exchange has once again been brought almost to a standstill on account of European affairs. There was no really heavy liquidation last week, but buyers were scarce and prices weakened in consequence. There is too much uncertainty as to the ultimate aims of dictator countries for any hopes of a return to activity in the near future, and business under these conditions will probably continue on a day to day basis for some time to come. Wall Street, too, is now becoming affected by the situation in London and this does not help to improve the position.

British Funds weakened and closed about a point down on the week, while home rails lost considerably more. There was not even the usual bright spot in the industrial section and quotations, particularly of some of the favourites, lost ground. For a short period during the week the mining markets staged a recovery, but this was short-lived, and any improvements were subsequently lost. Oil shares were without support and suffered with the rest.

It is satisfactory to report that throughout a trying week gas stocks and shares remained very steady and were comparatively well supported. In the Official List, apart from the usual *ex* interest markings at this time of the year, the only change was a gain of 1 point in Imperial Continental to 110½. M. Daladier's victory for his general policy should in normal times have given a stimulus to this stock, but France at the moment is beset with demands from abroad, and this may neutralize any chances of an appreciation in value. On the Provincial Exchanges an unexpected drop of 1½ points occurred in Bristol ordinary, and at Newcastle Blyth ordinary closed a point lower and the local Company's units weakened 3d. to 22s. 9d. In the Supplementary List, apart from *ex* interest markings, nominal quotations remained unchanged.

The Directors of the Plymouth and Stonehouse Gas Light and Coke Company have paid an interim dividend of £3 17s. 6d.% on the ordinary stock as against £4% for the corresponding period in 1937. The Company had distributed a dividend of 8% on this stock each year since 1928-29, but doubtless the heavier coal costs for the current period have necessitated the present small reduction in the interim dividend.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 9.	Rise or Fall on Week.
1,767,439	Sept. 5	8	8	Alliance & Dublin Ord. ...	130—140	...
374,000	June 20	4	4	Do. 4 p.c. Deb. ...	95—100	...
734,733	Nov. 7	5	5	Asscd. Gas & Water U'd'ts Ord.	17/-—19/-	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/-—21/-	...
444,389	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	19/-—21/-	...
296,523	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	16/-—18/-	...
500,000	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
560,070	Aug. 22	7	7	Barnet Ord. 7 p.c.	157—162	...
300,000	Oct. 10	1/9⅜	1/4⅜	Bombay, Ltd.	24/-—26/-	...
180,435	Aug. 22	9¼	9¼	Bournemouth sliding scale ...	195—205	...
640,407	,,	7	7	Do. 7 p.c. max. ..	157—162	...
495,960	,,	6	6	Do. 6 p.c. Pref. ...	130—135	...
50,000	June 20	3	3	Do. 3 p.c. Deb. ...	75—80	...
312,025	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...
357,900	Aug. 8	7½	7½	Brighton, &c., 6 p.c. Con. ...	142—147	...
659,955	,,	6½	6½	Do. 5 p.c. Con. ...	126—131	...
208,500	,,	6	6	Do. 6 p.c. 'B' Pref.	125—130	...
885,000	Sept. 19	8	7	British Ord.	133—138	...
100,000	June 3	7	7	Do. 7 p.c. Pref	140—145	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
450,000	,,	5	5	Do. 5 p.c. Red. Deb. ...	100—105	...
450,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
100,000	22 May'33	6	4	Cape Town, Ltd.	1—2	...
100,000	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ..	1½—3½	...
150,000	June 20	4½	4½	Do. 4½ p.c. Deb. ...	60—70	...
626,860	July 18	6	6	Cardiff Con. Ord.	118—123	...
237,860	June 3	5	5	Do. 5 p.c. Red. Deb.	105—110	...
98,936	Sept. 19	2/-	2/-	Colombo Ord....	1⅛—1¼	...
24,510	,,	1/4½	1/4½	Do. 7 p.c. Pref.... ...	22/6—24/6	...
739,453	Oct. 10	-/11-48	-/11-48	Colonial Gas Assn. Ltd. Ord.	16/6—18/6	...
296,144	,,	1/3-30	1/3-30	Do. 8 p.c. Pref. ...	22/6—24/6	...
1,775,005	Aug. 8	5	5	Commercial Ord.	78—83	...
140,000	..	—	§13/4	Do. 4 p.c. Red. Pref.	95—100	...
620,000	Dec. 5	3	3	Do. 3 p.c. Deb. ...	71—76*	—1
286,344	Aug. 22	5	5	Do. 5 p.c. Deb. ...	113—118	...
200,000	,,	—	§30/2	Do. 3½ p.c. Red. Deb.	97—102	...
807,560	Aug. 8	7	7	Croydon sliding scale ...	136—141	...
644,590	,,	5	5	Do. max. div. ...	100—105	...
620,385	June 20	5	5	Do. 5 p.c. Deb. ...	113—118	...
239,000	Aug. 8	5	5	East Hull Ord. 5 p.c.	95—100	...
186,155	Aug. 8	6	6	East Surrey Ord. 5 p.c. ...	116—121	...
176,211	Dec. 5	5	5	Do. 5 p.c. Deb. ...	112—117*	...
250,000	Nov. 7	8	4	Gas Consolidation Ord. 'B'...	19/-—21/-	...
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	17/6—19/6	...
9,223,324	Aug. 8	5⅜	5⅜	Gas Light & Coke Crd. ...	22/3—23/3ø	...
2,600,000	,,	3½	3½	Do. 3½ p.c. max. ...	79—82	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref....	98—101	...
2,993,000	July 4	—	3½	Do. 3½ p.c. Red. Pref....	98—101	...
8 602,497	Nov. 21	3	3	Do. 3 p.c. Con. Deb....	78—81	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb....	109—113	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb....	107—111	...
700,000	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb....	93—98	...
270,466	Aug. 22	6	6	Harrogate New Cons. ...	117—122	...
157,500	Mar. 21	1/2⅜	‡1/-	Hong Kong and China Ord....	½—1	...
213,200	Aug. 8	6	5⅜	Hornsey Con. 3½ p.c ...	97—102	...
5,600,000	Oct. 24	12	8	Imperial Continental Cap ...	108—113	+1
223,130	July 18	3½	3½	Do. 3½ p.c. Red. Deb....	87—92	...
235,242	Aug. 8	8½	8½	Lea Bridge 5 p.c. Ord. ...	162—167	...
63,480	June 20	3	3	Maidstone 3 p.c. Deb. ...	70—75	...
45,000	Nov. 21	†10	†10	Malta & Mediterranean ...	130—135	...
392,000	Oct. 3	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb. ...	100—105	...
231,977	Aug. 22	5	5	M.S. Utility 'C' Cons. ...	99—104	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref.	95—100	...
350,076	June 20	4	4	M.S. Utility 4 p.c. Deb. ...	95—100	...
148,955	,,	5	5	Do. 5 p.c. Deb. ...	113—118	...
125,000	July 1	3½	3½	Do. 3½ p.c. Red. Bds.	95—98	...
675,000	Nov 21	†6	†6	Montevideo, Ltd.	70—75	...
250,000	Aug. 8	7½	7½	North Middlesex 6 p.c. Con.	142—147	...
396,160	Aug. 8	5	5	Northampton 5 p.c. max. ...	105—110	...
300,000	Oct. 24	†7	†9	Oriental, Ltd.	145—150	...
468,537	Dec. 5	8	7½	Plymouth & Stonehouse 5 p.c.	135—145*	—5
621,667	Aug. 8	8½	8½	Portsmouth & Gosport Cons.	157—162	...
241,446	,,	5	5	Do. 5 p.c. max. ...	100—105	...
73,350	,,	5	5	Do. 5 p.c. Pref. ...	107—112	...
75,000	,,	4	4	Do. 4 p.c. Pref. ...	90—95	...
114,000	Aug. 8	5	5	Preston 5 p.c. Pref.	105—110	...
247,966	June 3	4	4	Primitiva 4 p.c. Cons. Deb. ...	98—103	...
625,959	July 18	4	4	Do. 4 p.c. Red. Deb. ...	94—99	...
15,000	Sept. 5	6	6	San Paulo 6 p.c. Cum. Pref. ...	8½—9	...
441,275	Sept. 19	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	20/6—22/6	...
460,810	Sept. 19	-/10⅜	-/10⅜	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...
133,201	Aug. 22	5	8½	Shrewsbury 5 p.c. Ord. ...	143—148	...
9,000	June 3	4	‡4	South African Ord.	4½—5½	...
1,371,752	Aug. 22	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	21/—23/-	...
871,636	,,	-/10⅜	-/10⅜	Do. 4½ p.c. Red. Cum. Pref.	19/—21/-	...
498,818	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/—20/-	...
450,000	Aug. 8	4	4	Do. 4 p.c. Deb.	99—102	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—97	...
6,709,895	Aug. 8	6	5	South Met. Ord.	103—106	...
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	128—133	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	95—100	...
1,895,445	June 20	3	3	Do. 3 p.c. Deb.	75—80	...
1,000,000	July 4	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...
600,000	,,	—	§31/-	Do. 3½ p.c. Red. Deb. ...	97—102	...
1,543,795	Aug. 8	6	6	South Suburban Ord. 5 p.c. ...	113—118	...
512,825	,,	5	5	Do. 5 p.c. Pref.... ...	108—113	...
500,000	,,	4	4	Do. 4 p.c. Pref.... ...	95—100	...
250,000	,,	3½	3½	Do. 3½ p.c. Red. Pref. ...	92—97	...
888,587	Dec. 5	5	5	Do. 5 p.c. Deb.	113—118*	—2
250,000	,,	4	4	Do. 4 p.c. Deb.... ...	95—100*	...
200,000	Aug. 8	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
427,859	Sept. 19	8½	9½	S. Western Gas & Water Ord.	16/—18/-	...
160,523	Oct. 10	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pf.	19/—21/-	...
110,000	June 3	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
750,541	Aug. 8	5½	5	Southampton Ord. 5 p.c. ...	105—110	...
148,836	June 3	4	4	Do. 4 p.c. Deb.	95—100	...
350,000	Aug. 8	5½	5½	Swansea 5½ p.c. Red. Pref. ...	105—110	...
200,000	June 3	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
1,076,490	Aug. 8	6½	6½	Tottenham and District Ord.	125—130	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref. ...	116—121	...
62,235	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
334,615	Dec. 5	4	4	Do. 4 p.c. Deb. ...	95—100*	...
85,701	Nov. 21	6	6	Tuscan 6 p.c. Red. Deb. ...	95—100	...
1,131,550	Aug. 22	6	4	U. Kingdom Gas Cor. Ord. ...	17/6—19/6	...
1,051,280	Nov. 7	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	19/-—21/-	...
762,241	,,	4	4	Do. 4 p.c. 1st Red. Cum. Pf	19/-—21/-	...
745,263	June 3	4½	4½	Do. 4½ p.c. 2nd Non-Cum.Pf.	15/6—17/6	...
1,066,186	Sept. 5	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—98	...
375,689	Aug. 8	7	7	Uxbridge, &c., 5 p.c.	125—130	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
1,371,138	Aug. 8	7	7	Wandsworth Consolidated ...	135—140	...
2,525,768	,,	4	4	Do. 4 p.c. Pref. ...	95—100	...
1,343,964	June 3	5	5	Do. 5 p.c. Deb. ...	115—120	...
383,745	,,	4	4	Do. 4 p.c. Deb. ...	95—100	...
400,000	,,	—	§25/-	Do. 3½ p.c. Red Deb.	97—102	...
558,342	Aug.	7	6⅞	Watford and St. Albans Ord.	128—133	...
200,000	,,	5	5	Do. 5 p.c. Pref. ...	107—112	...
200,000	,,	5½	5½	Do. 5½ p.c. Pref. ...	113—118	...
200,000	,,	—	16/8§	Do. 4 p.c. Red. Pref.	95—100	...
200,000	June 3	4	4	Do. 4 p.c. Red. Deb.	96—101	...
200,000	,,	3½	3½	Do. 3½ p.c. Red. Deb.	92—97	...

a.—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Cont.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Dec. 9.	Rise or Fall on Week.
202,152	Sept. 5	5	5	Ascot Ord.	101—106	...
128,182	July 18	5	5	Do. 5 p.c. Pref.	108—113	...
31,035	Aug. 22	-/4⅜	-/4⅜	Associated Utilities 4 p.c. Pref.	16/-—18/-	...
100,000	Dec. 13	...	3⅜	Do. 3⅜ p.c. Red. Deb. ..	95—100	...
17,000	Aug. 22	8	8	Bognor Orig. Ord. 'A' ...	155—165	...
62,210	,,	8	8	Do. New Addl. 'A' ...	155—165	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	145—155	...
37,440	Aug. 8	10	10	Cam. Univ. & Town 10 p.c. max.	188—198	...
125,970	,,	7	7	Do. 7 p.c. max.	133—138	...
39,025	,,	5	5	Do. 5 p.c. max.	97—102	...
96,410	July 18	4½	4½	Cardiff 4½ p.c. Pref.	95—100	...
150,000	Aug. 8	4	4	Croydon 4 p.c. Pref.	97—100	...
130,000	June 20	4	4	Do. 4 p.c. Deb.	95—100	...
65,000	Aug. 8	8½	7½	Eastbourne 'A' 5 p.c. ...	140—145	...
198,000	,,	7	6	Do. 'B' 3½ p.c.	114—119	...
112,312	,,	5	5	Do. 5 p.c. Pref.	107—112	...
130,000	June 20	5	5	Do. 5 p.c. Deb.	112—117	...
24,000	Aug. 8	8½	8½	Great Yarmouth 8½ p.c. max.	43—48	...
59,400	,,	7½	7½	Do. 7½ p.c. max.	33—38	...
51,160	Dec. 5	5½	5½	Do. 5½ p.c. Deb.	120—125*	—1
152,600	Sept. 5	9	8	Guildford Cons.	163—168	...
54,055	,,	5	5	Do. 5 p.c. Pref.	107—112	...
68,250	June 3	5	5	Do. 5 p.c. Deb.	107—112	...
156,600	Aug. 22	7½	7½	Hampton Court Cons. ...	131—136	...
80,000	Aug. 8	4	4	Lea Bridge 4 p.c. Pref. ...	90—95	...
60,000	,,	6	6	Do. 6 p.c. Pref.	121—126	...
94,876	Dec. 5	4	4	Do. 4 p.c. Deb.	94—99*	—1
73,620	Sept. 5	8⅜	8⅜	Luton Cons. 'A'	153—163	...
107,960	Sept. 19	5⅛	4	Mid Kent Ord.	8⅛—9⅛	...
230,940	Aug. 8	10	10	Oxford & District Ord. ...	195—200	...
47,112	,,	5	5	Do. 5 p.c. Pref.	106—111	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	107—112	...
126,193	Nov. 7	7⅛	7⅛	Peterborough Ord.	137—142	...
64,990	Sept. 5	6⅛	7⅛	Redditch Ord....	118—128	...
166,850	Aug. 8	8	8	Romford Ord....	142—147	...
60,000	,,	4	4	Do. 4 p.c. Pref.	99—103	...
44,000	Sept. 19	5	5	Do. 5 p.c. Deb.	112—117	...
25,570	Aug. 8	5⅛	5⅛	Rugby 5⅛ p.c. Pref.	120—125	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	104—109	...
42,750	Dec. 5	5⅛	5⅛	Do. 5⅛ p.c. Deb.	117—122*	—1
110,950	Aug. 22	8	8	Ryde Ord.	140—150	...
270,086	Sept. 5	7	7	Slough Ord.	128—133	...
21,000	June 20	5	5	Do. 5 p.c. Deb.	110—115	...
28,872	Nov. 7	5⅛	5⅛	S. Midland Gas Cpn. Ltd Ord.	19/-—21/-	...
28,866	Sept. 5	4⅛	4⅛	Do. 4⅛ p.c. Red. Cum. Pref.	18/-—20/-	...
117,228	Aug. 8	7	5	Swindon Cons.	102—107	...
60,425	Dec. 5	5	5	Do. 5 p.c. Deb.	110—115*	—2
64,380	June 3	5	5	Torquay & Paignton 5 p.c. Pref.	107—112	...
130,000	Aug. 8	8	5	Wakefield Ord.	116—121	...
81,650	,,	5	5	Do. 5 p.c. max.	100—105	...
82,000	Aug. 8	6	6	Weymouth Ord.	103—108	...
98,384	Aug. 22	6	6	Wolverhampton 6 p.c. Pref.	118—123	...
160,000	June 20	5⅛	5⅛	Do. 5⅛ p.c.Rd.Db.	105—110	...
90,000	June 20	5	5	York 5 p.c. Red. Deb. ...	104—109	...
133,640	July 18	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	118—123	...
120,000	,,	5	5	Do. 5 p.c. Pref.	105—110	...
35,000	Dec. 5	5⅛	5⅛	Do. 5⅛ p.c. Deb.	120—125*	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 9.	Rise or Fall on Week.
347,756	July 18	6	5	Bath Cons.	117—119	...
1,667,250	July 18	5	5	Bristol, 5 p.c. max.	111—113	—1½
120,420	June 3	4	4	Do. 1st 4 p.c. Deb. ...	100—102	...
217,870	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100—102	...
328,790	,,	5	5	Do. 5 p.c. Deb.	119—122	...
274,000	Aug. 8	5	5	Newport (Mon). 5 p.c. max....	97—99	...
13,200	Sept. 19	8⅔	7	Pontyp'l Gas & W. 10 p.c. 'A'	12⅞—13⅜	...
13,600	,,	6	5	Do. 7 p.c. 'B'	11⅛—12⅛	...
40,000	,,	6	5	Do. 7 p.c. 'C'	11⅛—12⅛	...
140,778	Aug. 8	5	5	Weston-super-Mare Cons. ...	106—108	...
64,338	June 20	4	4	Do. 4 p.c. Deb.	100—102	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	151—154	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 9.	Rise or Fall on Week.
157,150	Aug. 8	6½	5	Chester 5 p.c. Ord.	109—111	...
92,500	June 20	4	4	Do. 4 p.c. Pref.	95—99	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	87—90	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	97—101	...
2,167,410	Aug. 22	6	6	Liverpool 5 p.c. Ord.... ...	122½—124½	...
245,500	June 20	5	5	Do. 5 p.c. Red. Pref. ...	100—105	...
306,083	July 18	4	4	Do. 4 p.c. Deb.... ...	100—102	...
106,280	Aug. 8	10	10	Preston 'A' 10 p.c.	198—208	...
188,219	,,	7	7	Do. 'B' 7 p.c.	131—141	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 9.	Rise or Fall on Week.
122,577	Aug. 8	8	8	Blyth 5 p.c. Ord.	160—162	—1
732,000	Aug. 22	5	5	Hartlepool G. & W. Cn. & New	89½—90½	...
2,061,315	Aug. 8	5⅜	5	Newcastle & Gateshead Con.	22/6—22/-a	—/3
682,656	,,	4	4	Do. 4 p.c. Pref. ...	99⅛—100⅛	...
776,706	June 20	3½	3½	Do. 3½ p.c. Deb. ...	89 —90	...
277,285	Oct. 24	5	5	Do. 5 p.c. Deb. '43 ...	103¼—105¼	...
332,351	Aug. 22	6	6	Sunderland 6 p.c. max. ...	135—137	...

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 9.	Rise or Fall on Week.
542,270	Aug. 8	9	6	Derby Con.	133—138	...
55,000	June 3	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	June 20	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...
£0,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Dec. 9.	Rise or Fall on Week.
10,000	Aug. 8	10	10	Great Grimsby 'A' Ord. ...	205—215	...
6,500	,,	10	10	Do. 'B' Ord. ...	205—215	...
79,000	,,	10	10	Do. 'C' Ord. ...	195—205	...
1,806,339	Aug. 22	6½	6½	Sheffield Cons.	140—142	...
95,000	July 4	4	4	Do. 4 p.c. Deb.	101—103	...

a The quotation is per £1 of Stock. * Ex div.

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